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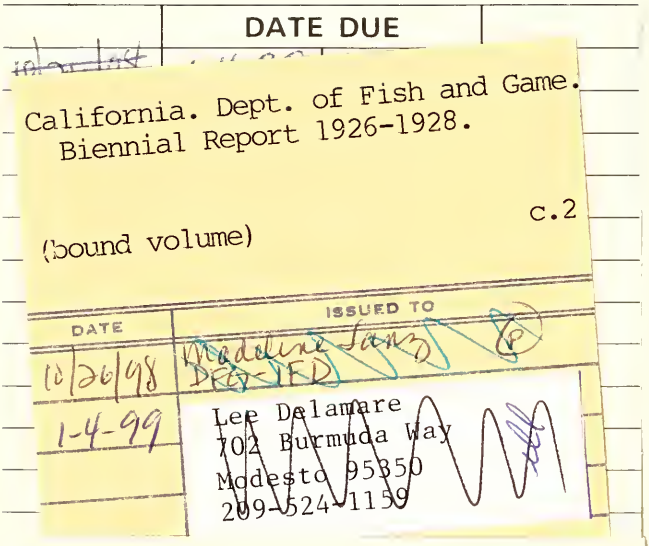

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STATE OF CALIFORNIA

DEPARTMENT OF NATURAL RESOURCES

Division of Fish and Game

THIRTIETH BIENNIAL REPORT

For the Years 1926–1928

63870

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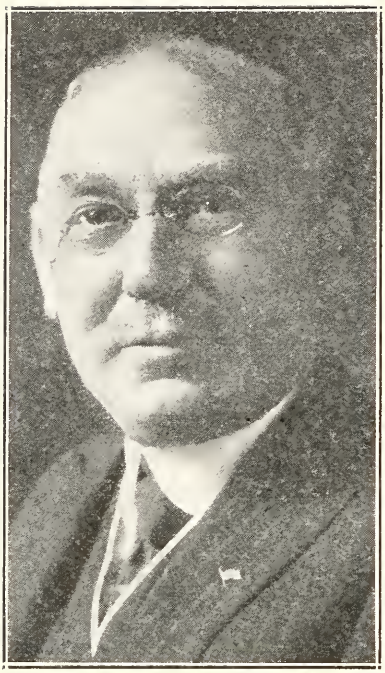
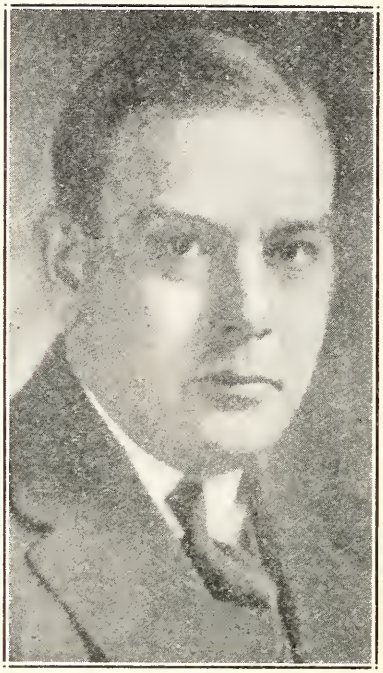


I. ZELLERBACH, Fish and Game Commissioner, President.



REGINALD G. FERNALD, Fish and Game Commissioner.

GEORGE B. CLARKSON, Fish and Game Commissioner.

EUGENE D. BENNETT, Executive Officer.

LETTER OF TRANSMITTAL

San Francisco, September 30, 1928.

His Excellency C. C. Young,
Governor, State of California,
Sacramento, California.

Sir: In compliance with law we submit herewith a report of the activities and accomplishments of the Fish and Game Commission and the Division of Fish and Game, for the biennial period from July 1, 1926, to June 30, 1928.

This report consists of a summary by the executive officer, and also detailed reports of the several bureaus of the Division, and in the appendix a complete statistical statement.

We wish to take this means and opportunity to express our appreciation for the considerate interest manifested in and the helpful cooperation extended to this Division by Your Excellency, the members of the legislature, the officers and several departments of the state government during the past biennium.

Respectfully submitted.

I. Zellerbach,
Reginald G. Fernald,
Geo. B. Clarkson,
Fish and Game Commission.

In Memoriam

Listed here are those faithful, self-sacrificing workers for conservation who, through death during the past biennium, have left their work and their spirit to other hands.

	Entered Service	*Age*	*Died*
W. J. Green	November 1, 1911	63	January 17, 1927
D. E. Roberts	October 1, 1911	62	April 12, 1928

FIG. 1. Scene at Mount Shasta Hatchery. Six hatchery buildings and fifty-four brood ponds make this the largest of California's hatcheries. Photograph by E. S. Cheney.

THIRTIETH BIENNIAL REPORT

REPORT OF EXECUTIVE OFFICER

Honorable Board of Fish and Game Commissioners
of the State of California,
San Francisco, California.

SIRS: During the preceding biennium certain changes in personnel and organization have occurred which are in order to note.

On September 2, 1927, Governor C. C. Young appointed Mr. Reginald G. Fernald of Santa Barbara and Mr. George B. Clarkson of Los Angeles, and reappointed Mr. I. Zellerbach of San Francisco as Fish and Game Commissioners. Shortly after these appointments were made the Commissioners met and elected Mr. Zellerbach the president of the board, which position he previously held. On December 1, 1927, the undersigned became executive officer and attorney, succeeding Mr. B. D. Marx Greene.

Pursuant to the acts of the 1927 legislature, organizing the various commissions and boards of the state government into departments, the duties, powers, purposes, responsibility and jurisdiction of the State Fish and Game Commission were transferred to the newly created Department of Natural Resources comprising the Division of Fish and Game, the Division of Mines and Mining, the Division of Parks and the Division of Forestry—the Division of Fish and Game to be administered through a Fish and Game Commission to be appointed by the Governor to serve without compensation and to hold office at his pleasure. You gentlemen, comprising such Commission, have continued to function much to the extent and in the same manner as did former boards of fish and game commissioners. The Commission has frequently met to transact the business before it, hold hearings, make orders, grant permits, receive the reports of the executive officer and lay out the general policy and program for the division to follow under the immediate supervision and direction of the executive officer.

Early in 1928 the accounting work of all the divisions was taken over and is now being administered by the Department of Natural Resources at Sacramento.

Monthly meetings of the chiefs of the divisions of the Department of Natural Resources have been held at Sacramento, which were attended by the executive officer, who rendered a current report of the business and activities of the division to the Director of Natural Resources who, in turn, transmitted the substance of such reports to the monthly meeting of the Governor's Council.

During the biennial period the plan of centralized and uniform administration for the whole state has been carried out and proven effective.

Realizing the increasing problems of wild life conservation and restoration, but anticipating greater opportunities by reason of a larger revenue from the increased license fees provided by the last legislature and effective this year, efforts have been made and a plan of action initiated considerably enlarging the scope and extending the field of

endeavor, and while the greater opportunity and results therefrom were not fully realized during the past biennium, some considerable progress and benefits have been accomplished as evidenced by the fact that during the last six months' period of the biennium, January 1 to June 30, 1928, there were more than double the number of arrests made, convictions had, and amount of fines paid than during any previous like period.

In addition to an enlarged and more efficient patrol force, both regular and volunteer, making possible better law enforcement and a more uniform and effective method of fish distribution, rescue and planting by the members of such force, other accomplishments are:

An increased number of hatcheries and rearing tanks; new and additional fish planting trucks with the newest and most improved aerating equipment; the propagation and liberation of a greatly increased number of pheasants and game birds; the survey and posting of large areas of land set aside as game refuges; the satisfactory control of oil pollution in river, bay and ocean water; the valuable study and investigation for the prevention of fish, bird and animal diseases by a staff of

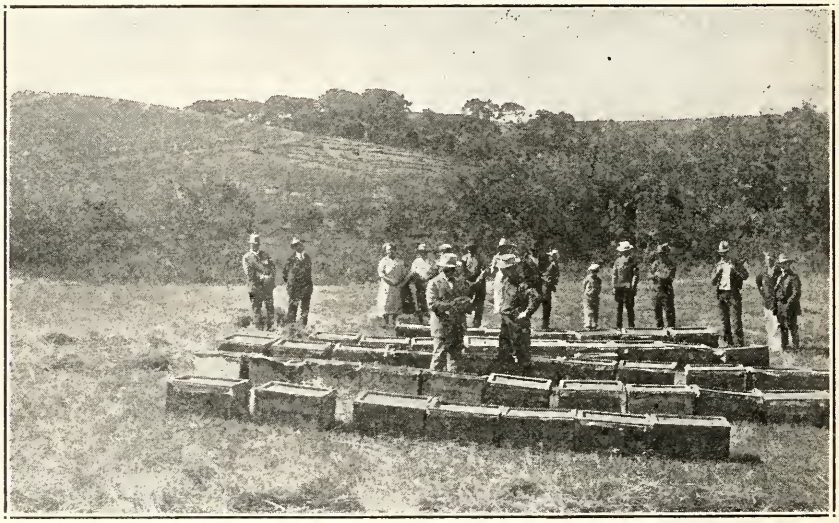


FIG. 2. A typical liberation of ring-necked pheasants. Shipping cases are placed in a field, doors opened and the birds allowed to walk out and find their new home. Sometimes they fly a considerable distance. Photograph by Sidney Snow.

scientifically trained specialists; the employment of trappers and cooperation with federal and state agencies for the more effective control of predatory animals in our refuges; the successful prevention of botulism in canned fishery products; the financial assistance to and cooperation with the State Board of Health in the control of stream pollution; beneficial strides in the eradication of carp from Clear Lake; the establishment of a comprehensive reference library; an augmented education and lecture service, with additional and better motion picture films, and other material; the successful enforcement of fish reduction and commercial fishery laws as the result of litigation and otherwise; an accurate statistical compilation of deer killed throughout the state

and in the several counties, through the application of the deer tag license law; the statistical compilation of fur bearing animals by species trapped in the state; the appointment of a committee provided by legislative act to investigate and recommend game refuge sites to be purchased and maintained out of the special fund consisting of one-third of the amount received from hunting licenses; the closure of certain streams and lakes throughout the state for better protection and conservation of trout, pursuant to power granted the Department of Natural Resources by the last legislature, as well as other items mentioned in and by the reports of the chiefs of the several bureaus of the division.

The following is a summary of bureau activities:

FINANCE AND ACCOUNTS

Prompt payment of expense claims to employees has been secured by utilizing a revolving fund.

A change has been made in the distribution of hunting and angling licenses. In times past practically all licenses were distributed and sold by county clerks. Of recent years, some county clerks declining to handle licenses, the division has been required to and has distributed licenses direct to sporting goods houses, hardware stores and other establishments, where they are in turn sold to the public. Such agents remit the full value of the licenses and the money is deposited in the bank as a special account known as the bond trust account. At the end of each month the licenses actually sold are checked and the transfer made from the bond trust account to the credit of the state treasurer. In many localities the commission on license sales has been entirely retained by the county clerk, in other instances shared with the retail agent.

The number of hunting licenses sold for the fiscal year 1926–1927 amounted to 253,532, and in the following fiscal year to 257,738. There was also an increase in the number of angling licenses sold, being 246,167 in 1926 and 262,886 in 1927. Outside of a slight decrease in wholesale fish dealers' licenses, an increase is shown in other license sales.

Trapping license sales increased from $3,872 for the fiscal year beginning July 1, 1926, to $5,347 in the fiscal year beginning July 1, 1927. The license on commercial duck clubs amounted to $1,475, and the operators' license sales to $410.

PATROL

The Patrol Bureau was reorganized in October, 1927. A number of new captains were appointed and certain deputies placed under the direction of these captains.

That law enforcement has been stimulated is evidenced by the increased number of arrests, the total being 4390 for this biennial period as compared with 3107 during the preceding biennium. A total of $147,254.50 was assessed in fines, together with 8504 days of imprisonment. This indicates an average of six arrests per day and an income from fines of $201.70 for every day in the two years' period. The greatest increase of patrol activity, as reflected by arrests and fines, was during the last six months of the biennium, when there were more than double the number of arrests made, convictions had, and amounts of fines received than in any like period.

At the close of the biennium the patrol department numbered 122 men on the pay roll as compared with 77 at the close of the preceding biennium. These are well distributed throughout the length and breadth of the state.

In order to make the patrol more effective a number of boats have been made available, and in other instances outboard motors have been furnished. Three canvas boats, easily transportable, have been purchased and are being put to good use.

One of the serious problems of the patrol force has long been the control of market hunters in the Sacramento Valley. In order to handle a bad situation a camp was established near Maxwell, where the deputies work in the duck fields, and have a chance to change their wet clothes and get a warm meal. Night shooting, ground sluicing and

Fig. 3. Jay Bruce, lion hunter, with a take of five lions.

bootlegging of ducks during the winter of 1927–1928 was made a far more difficult thing than in the past.

An important, far reaching step in the building of a more efficient patrol force consisted of placing such force in uniform, which is now a dark green color, practical for service, clothing the deputy with more official standing, giving him better protection, and creating a better impression in his community. Other states which have adopted the uniform all report marked improvement. In certain instances, where necessity requires, a deputy is permitted to wear other clothing that will not reveal his identity.

VOLUNTEER DEPUTIES

At the 1927 session of the state legislature the Fish and Game Commission was empowered to employ deputies with or without pay. This made possible the building up of a volunteer warden system in a better way than previous experience with dollar-a-year and nonsalaried wardens. A captain of patrol was placed in charge of the organization and instruction of these volunteer deputies. Under the present regulations 790 men have been commissioned as volunteer deputies. Of these 340 were regular members of the United States Forest Service and 450 were sponsored by bona fide fish and game protective associations and the commission. In welding these volunteer deputies into a working system under the department of patrol considerable pioneering has been necessary. However, some satisfactory results have been had and the whole project is being watched and handled by the division with the greatest scrutiny and care to see if it is possible to secure an effective, widespread means of law enforcement with but little cost and financial outlay. Reports indicate that during the biennium 31,900 licenses were checked and 336,152 miles of territory were patrolled by volunteer deputies, and that they also arrested or assisted in the arrest of 487 violators. Mention should likewise be made of the splendid assistance furnished by county game wardens, who have also been appointed volunteer deputies.

FISH PLANTING

In times past, fish from the hatcheries were allotted to boards of supervisors, sportsmen's organizations, and other groups and individuals, and as a result fish oftentimes were placed in streams which dried up, and in other unsatisfactory locations. Nor was there a uniform system of allotment. Neither were the many inexperienced people receiving such fish able to give them the proper care, and as a result many fish died, or were improperly planted. The system of allotment was accordingly changed, emphasis being directed upon placing the fish in the best possible situation. Deputies of our patrol force were asked to secure recommendations from reliable sources and, in addition, make their own investigations and report same to their captain. Captains of districts were required to consolidate the allotments for the whole district and forward to the captain in charge of fish planting for the whole state, who, in conjunction with the superintendent of fish culture, revised and consolidated these reports from which formal hatchery allotment sheets were prepared. Fish from hatcheries were consigned directly to the captain, who had complete charge and control of the planting within his district. He was assisted by the deputies, sportsmen and others.

Additional advantages have been realized by this new method of planting, in that fish are handled by more experienced men, shallow and suitable water is selected for planting, and fish are widely scattered instead of being dumped into one large pool where overcrowding is the result, and larger fish take a toll by cannibalism. Captains and deputies during 1927 assisted and directed the planting of over eighteen million trout in lakes and streams with small resulting loss. Each year should see more improvements and better results in this work as the field force become more experienced and better trained, and better equipment is secured.

An additional aid in fish distribution has been found in the equipping of two trucks with an aeration apparatus. In such trucks fish can be transported long distances, and with sufficient time available at the terminal to allow for distribution.

FISH CULTURE

The Department of Fish Culture entered the past biennium with numerous hatcheries badly in need of repair. With more funds available such hatcheries were placed in first class condition. During the biennium thirteen new hatcheries have been constructed.

The new Burney Creek Hatchery, built by the Pacific Gas and Electric Company in lieu of fishways on the dams in the Pit River, has a capacity of 3,500,000 fish. The buildings are substantially con-

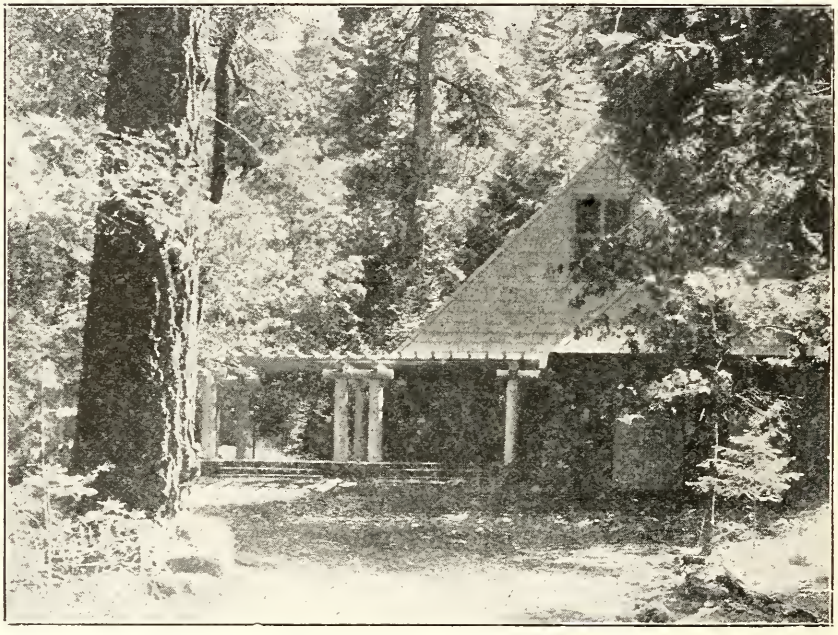


FIG. 4. Yosemite Fish Hatchery, now in its second season of operation. Photograph by H. C. Bryant.

structed, and a superintendent's cottage, garage, and food preparing room are included. This hatchery will furnish fish for the Pit River and streams in the northern and eastern parts of the state.

There long existed a need for a state hatchery in Yosemite National Park. In 1919 an experimental hatchery was operated, which experiment proved successful. However, it was not until 1926 that arrangements were concluded with the government for the building and maintenance of a regular hatchery and a fine group of hatchery buildings have been constructed there by the state during the past biennium. They constitute not only an attractive addition to the valley, but have proven valuable as a means of supplying the many lakes and miles of streams within the confines of the national park with several species of trout.

A splendid aquarium has been built in the main hatchery building exhibiting various kinds and species of trout raised in the state. An outdoor pond is contemplated for similar purposes.

Aside from utilitarian purposes, the hatchery is proving a very valuable means of interesting and educating a great number of our people in the work that is being done by the state in the propagation and planting of fish. Hundreds of people from all parts of the state and elsewhere fill this hatchery daily. Here they observe how actual fish culture operations are conducted and are given further understanding of the biology of fish life and the necessity for its conservation through the medium of lectures which are given by trained men stationed at the hatchery during the summer time.

In the fall of 1926 a fine new hatchery was built on June Lake, Mono County. In the spring of 1927 an experimental hatchery was established on Walker River, Mono County. During the winter of 1927 a permanent hatchery was erected at Hammond. This is known as the Kaweah Hatchery, and contains fifty troughs.

Due to the fact that the water supply at Ukiah Hatchery was insufficient, it was deemed best to find another site in Mendocino County. After a survey, a new hatchery was established on Cold Creek and a hatchery building completed in March, 1928. This is a fifty-two-trough hatchery, with a cottage for the superintendent and rooms for the help. A tank system and other improvements will be installed in another year.

During the fall of 1927 an experimental hatchery was established on the Kern River near Kernville. The location did not prove suitable. The loss in young fish during the year was heavy and it is probable that the site will have to be abandoned.

A first-class hatchery with a capacity for 1,500,000 trout was established on Big Creek, near Swanton, in Santa Cruz County.

A centrally located site for the distribution of fish from the upper San Joaquin River tributaries was located on Kings River about thirty-five miles east of Fresno. Considerable expense and labor were required to construct a diverting dam so as to provide a constant flow of water. It is possible that a permanent hatchery building eventually will be established at this site.

In order to rear fish for southern California waters, two tank stations were built. Ten tanks, with a capacity of approximately fifty thousand fish, were erected on Forsee Creek, a tributary of the Santa Ana River. Another tank station of equal size was erected on the San Gabriel River at Coldbrook Camp. Both stations are situated on national forest lands.

The Bureau of Fish Culture is now operating 25 hatcheries and 12 egg collecting stations. The output from the hatcheries during the past biennium amounts to 51,444,562 trout and 26,728,590 salmon, making the total of hatchery-reared fish 78,173,152, in addition to 11,281 fish rescued from overflowed areas and planted in reservoirs and lakes at low altitudes.

Another attempt was made to import ayu eggs from Japan. The ayu is a notable food fish in Japan and this is not the first time shipments of eggs have been made. When the eggs arrived in November of 1926 they were in poor condition and not an egg was hatched.

The director of the Bureau of Fish Culture continues to recommend an enlarged pond system for brood fish. In his opinion the securing of eggs from wild fish is always a difficult and expensive matter. It is proposed that during the coming year more extensive study will be given to the possibilities of taking wild eggs from mountain lakes and reservoirs, and a comparative study made of this method and pond cultural methods. Fortunately, under the powers now given the Director of Natural Resources to close lakes and streams, we are better enabled to preserve breeding places for fish so that a supply of eggs is more assured than in the past.

A considerable and widespread advocacy of the rearing of fish to adult or larger size before being planted has received attention by the division during the past biennium. Certain experiments were conducted by furnishing large numbers of small trout to various sportsmen's organizations, who planted them in retaining ponds and undertook the care and nurture of the fish until they were ready to be released. In a few instances some success was had, in others, total failure. Success in such ventures depends on ideal conditions and scientific and competent care, otherwise considerable expense is incurred and no results obtained.

The undersigned is not ready to say that such proposed system is not of value. Further experimentation, with open mind, is necessary to make such determination. The Flycasters Club of San Francisco, at considerable expense, constructed a series of concrete holding tanks on the Truckee River. They have received fish for three years and reared them to a size of approximately five inches before they were released in the Truckee River. This club is strongly in favor of the plan and has been willing to back it up by its own expenditure of time, money and effort. The results it has had and will have in the future will add to our sum of knowledge.

To accomplish the same ends, and in lieu of holding ponds, rearing tanks have been erected at several of our hatcheries which have been used in rearing fish to larger size before being planted. This whole subject matter is presently being made the object of study and investigation by our fish culture and research departments. At the present time the consensus of opinion seems to be that in certain instances and localities it pays and is better to plant large fish, while in other localities small fish are better adapted, due to the greater economy of operations.

An additional scientific investigation now under way is to determine a more economical food than liver, which is now generally fed, and the cost of which has become almost prohibitive.

HYDRAULICS

The Bureau of Hydraulics was organized shortly before the beginning of the past biennium to take charge of pollution problems and the installation of fishways and screens. The bureau consists of an engineer and one assistant.

The duties of this bureau are concerned with the general examination of mill races, ditches, pipes, dams, artificial obstructions, etc., in rivers and streams to determine the necessity for a fishway or screen and to order such installations when necessary. Blueprints of the fishway or screen ordered are prepared by this bureau.

An investigation during the biennium has revealed that the number of screens installed during past years amounts to 1084 and the number of fishways to 419. It appears that in a number of these instances the orders issued by the Commission were not complied with and no screens or ladders were installed. Due to the fact that the original surveys and orders were made and issued years ago, it has in most cases been necessary to make resurveys before making new orders or commencing litigation to enforce the construction of such fishways or screens. This phase of our activities is highly important to the conservation of fish life and it is purposed to place increased emphasis on it to the end that wherever required screens and ladders will be installed and kept in proper order. In some instances the irrigation districts and power companies have resisted the order of the Commission and litigation has been required to compel installation. Several important suits which will have a widespread influence upon the future, are now pending.

In addition to this, the bureau has concerned itself with the prevention of oil pollution, principally in the bay and ocean waters. During the last year of the biennium intensive investigation and survey was made of this problem as it existed throughout the state. In a number of instances it was found that the extensive oil drilling operations in southern California fields had caused a serious problem of oil pollution to occur and complaints received were not only from sportsmen and commercial fish interests, but also from many of the cities and towns of that area complaining of the ruination of their beaches. By negotiation, a number of these nuisances were abated and steps voluntarily taken by the oil companies to prevent further trouble. In several instances suits were instituted in the superior courts to enjoin the further continuance of such nuisances and in each instance these suits were successfully maintained by the division, injunctions were issued, and the defendants have taken steps to clean up their premises and prevent the escape of oil and pollution in the future. On the whole, this situation is in a far more satisfactory state than it has ever been before.

RESEARCH

The Bureau of Research and Statistics has been enlarged during the past biennium to include the employment of a parasitologist and a pathologist, both of whom are stationed at Hooper Foundation for Medical Research at San Francisco and operate under Dr. K. F. Meyer, the director of that institution, who has accepted the appointment as consulting pathologist of the division.

This group is conducting exhaustive experiments to ascertain the cause and means of prevention of the so-called duck diseases which have affected thousands of migratory waterfowl throughout the state, as well as other diseases of our game and fur mammals, game birds and fish. The extent of the work undertaken and results had to date will more fully appear in the report of Mr. Ludlum, who has acted as the chief of this bureau.

In addition to the above, certain valuable statistical information has been obtained and compiled showing the total of deer killed not only for the state but in each county and the place of residence of the hunter. These statistics will prove of great value in fixing seasons and bag limits, as they furnish the basis of an accurate

determination of the status and supply of this, our largest game animal that can be legally killed.

For the first time in the history of the state accurate records have been obtained showing the annual toll of fur-bearing animals taken by trappers and the value of this industry to California; showing also that commercial trappers furnish a very important agency for the control of predatory animals.

PUBLIC RELATIONS

In the past biennium this bureau, consisting of a director, has had charge of the matter of dissemination of publicity, as well as the establishment of helpful relations with public officers, sportsmen's organizations, and the public at large. Through the efforts of this bureau, thousands of newspaper articles favorable to fish and game conservation have appeared in the public press throughout the state.

EDUCATION

The personnel of this bureau has been enlarged to include additional lecturers. A good working reference library has been added, and much valuable equipment and material, including motion picture films and exhibits procured, to the end of making its functions more effective, *i. e.*, a greater appreciation and knowledge of nature and wild life, to the end that wanton or illegal destruction will not be committed.

A definite lecture program for schools has been inaugurated. Most of the rural schools of Imperial and Ventura counties were visited by a lecturer. Another lecturer spent considerable and very effective time and effort in the public schools of Oakland. The educational program in the summer resorts at Yosemite National Park and California State Redwood Park continued. It was estimated that during certain months of the year more than twelve thousand persons attended lectures given by representatives of this bureau.

A number of valuable publications for the use of teachers have been issued, and assistance is constantly given the schools and other institutions with problems and questions concerning wild life in this state.

California Fish and Game, a quarterly magazine, has now an enlarged circulation, and continues to carry conservation ideals and accomplishments to the public.

The personnel of this bureau have arranged for and assisted in the instruction of the field force of this division at their annual conventions which have been held in San Francisco. It is contemplated that this bureau will shortly institute a course of training for the field members of the division to better train them in the science of the life habits and characteristics of wild life.

To better understand the extent and scope of this field of our work, it is suggested you read the full report submitted by Dr. Harold C. Bryant, who has been in charge of this work since its inauguration many years ago.

GAME FARM

California's new game farm at Yountville, Napa County, was completed and dedicated on August 27, 1926. The choice of a site was made after a complete survey of the state, and fifty acres of a farm already owned by the state were utilized. Soil and climatic conditions

are proving ideal. The main enclosure, surrounded by a vermin-proof fence, includes about 7⅓ acres which is completely roofed by wire. This is divided into 472 pens 24′ x 24′. During the past year other pens have been added.

With its home for the superintendent and help, and other additions which have been made, this farm is probably the largest and best equipped game farm in the United States.

Outstanding is the watering system, which, equipped with sprinklers, keeps half of each pen with moist conditions sufficient to insure the growth of plant life for food and cover. The presence of these growing plants attracts insect life, which is necessary as a food.

FIG. 5. Entrance to Trinity County Game Refuge. During the past year nearly half of the state's refuges have been surveyed and posted.

A large number of bantam hens are used for incubating the eggs and rearing the young. Emphasis has been placed on the rearing of ring-necked and Mongolian pheasants. The first year about 3000 birds were reared and planted. The second year of operation totaled close to 8000 birds.

The distribution of birds reared on the game farm has been made after attention to the following details: First, a suitable location is chosen by the superintendent. Second, each plant is sponsored by some sportsmen's club or group of responsible citizens, and the area closed to hunting, and posted. Additional plants are made in succeeding years in order to assure sufficient breeding stock. With such care taken in distribution, good results are to be expected, and favorable reports have been received from many localities throughout the state. Where pheasant plants have been made the sportsmen and local people have, on the whole, become quite enthusiastic. In Oregon, where there now exists an open season on these introduced birds, it is considered one

of their principal sports. With the results obtained from our present farm and the farm which it is contemplated will be constructed during the coming year in southern California, it is possible to conceive that the state may have an open season on pheasants within a short time.

A number of valley quail are reared each year, and experiments are being made with wild turkeys from Arizona, as well as Hungarian partridges, and certain species from South America.

A constructive step in game bird propagation is propagation of quail in their wild state in protected areas, later trapping these birds and distributing them for the purpose of introducing new brood stock, as well as replenishing areas that have been shot out. This is already being undertaken in certain parts of the state, and under the supervision of this division greater progress is expected.

Fig. 6. Preparing to burn confiscated illegal nets. May, 1928. Photograph by H. C. Bryant.

GAME REFUGES

With the passage of an act by the last legislature increasing the hunting license fee from $1 to $2, it was provided that the Fish and Game Commissioners should expend for a period of five years, beginning with January 1, 1928, not less than one-third of all moneys collected annually from the sale of such hunting licenses, in the purchase, lease or rental, and the development, improvement, maintenance and administration of land and water rights suitable for game refuges or public shooting grounds, or both.

It was further provided that a committee should be appointed, to be known as the Game Refuge and Public Shooting Grounds Advisory Committee, to consist of the Director of the California Academy of Sciences, the Director of the Hooper Foundation for Medical Research of the University of California, and five other members to be selected by the Fish and Game Commissioners, with the approval of the Gover-

nor, each member of the committee to serve at the pleasure of the appointing power and without pay. On March 22, 1928, this committee was appointed, consisting of the following members:

Jacob Baum, Los Angeles.
H. L. Betten, Alameda.
J. Dale Gentry, San Bernardino.
Manley S. Harris, San Francisco.
Nathan Moran, San Francisco (Chairman).
Dr. K. F. Meyer, San Francisco (Director, Hooper Foundation).
Dr. Barton W. Evermann, San Francisco (Director, California Academy of Sciences).

Since their appointment the members of this committee have held meetings to consider the problems before them, and Mr. J. S. Hunter, in charge of state refuges, was assigned as their special assistant. A survey of the state was commenced and it is possible that a definite program to cover the five years will be fully outlined and agreed upon before any of the moneys are spent, this prevention being taken to avoid hasty or ill-advised investment. As the funds for such purpose did not accrue during the past biennium, it was impossible to take any further action than as above noted.

During the past biennium a special crew of surveyors under the direction of Mr. J. S. Hunter has been engaged in making an accurate survey and posting 34 state refuges, including 2,372,355 acres of land. This is an important step, as in many instances these refuges had not been accurately surveyed and prosecutions were difficult where adequate postings were not made.

Coincident with this work an effort has been made to take a census and make a more accurate analysis of game conditions throughout the state. The application of the deer tag license revealed that in 1927, 19,507 deer were legally killed in the state. The records show that a surprising percentage of well antlered deer is killed, which reasonably indicates that only the surplus is being taken.

The greatest step forward in the protection of waterfowl was when the federal law and later the state law stopped the sale of ducks. Geese are in need of further protection. There should either be a closed season, or the shooting of geese over live decoys should be forbidden.

The new legislation shortening the season during which quail can be killed to the month of December, has been beneficial. Under this law quail have increased in all parts of the state.

Doves are holding their own under the present legislation, which limits the hunting season to two months or less. Grouse in general have been reduced, possibly due to the destruction of their nests by sheep.

Of the former great herds of elk that ranged in the interior valleys only a few hundred head remain. With scarcely an exception attempts to plant small herds have proved unsuccessful, as they destroy the cultivated crops when given free range. If they are to be permanently preserved it will be necessary to secure and fence refuges for them.

Antelope, as the result of protection, are increasing in northwestern California. The advance of agriculture has practically exterminated them in other areas where they were formerly abundant.

Mountain sheep are reported in a number of localities in the desert mountain ranges of southeastern California, and under proper protection this species should be capable of being permanently preserved, although it is doubtful if the time will arrive when an open season can be permitted.

Ring-necked pheasants, as I have previously stated, are now found in almost every part of the state.

With a very large acreage of private land posted against hunting, and with a large number and acreage of state refuges, game birds and animals have a fair opportunity to reproduce and maintain the species.

The division is making an increased effort toward sensible predatory animal control, but is to date opposed to the so-called bounty system, which has been discarded as unsatisfactory by the federal government and most state agencies. Assuming the state were to pay a bounty of $5 for every coyote killed, there would be an immediate obligation of approximately $70,000 a year to trappers and others who kill coyotes now for their pelt without any bounty being offered; and if the bounty system is to extend to all animals that are deemed predacious, it would take anywhere from a quarter of a million to a million dollars a year to pay bounty on animals that are normally killed each year.

Fig. 7. Exhibit used at several county fairs.

COMMERCIAL FISHERIES

This bureau has immediate charge of the enforcement laws, the promulgation, supervision and enforcement of rules and regulations governing commercial fishing and the manufacturing of fishery products within the state. Licenses are required of commercial fishermen and permits are issued to manufacturers of fishery products.

During the year a number of hearings are had to determine the capacity of canning plants, and whether or not such and other manufacturing plants are entitled to a permit to take food fish for manufacturing purposes.

A patrol and inspection service is maintained by this bureau to see that the terms of the permits and licenses are complied with, and the law in general enforced.

A large, well equipped laboratory is maintained at Terminal Island, San Pedro, with the function of conducting scientific investigations of our marine fishes, to furnish information and knowledge of their supply, breeding grounds, habits and other characteristics; to serve as a practical aid to the commercial fishing and canning industry, as well as providing a means of more accurately determining the proper seasons or restrictions to insure conservation.

The value of California fishery products reaches the astonishing figure of twenty-five million dollars. This was due partly to the great diversity of commercial fishes a year. There are over sixty species of fresh and shell fish, thus allowing a year round supply of fresh edible food fish for our California markets, as well as canned products for the whole world. Of the varieties caught, the sardine catch exceeds the combined catch of all other species three to one.

In the sardine canning industry the manufacture of by-products appears to be the most profitable part of the business. Indeed, the out and out reduction of fish for fertilizer is by far the most profitable method of using sardines, and if the state law did not prevent the unrestricted manufacture of this food fish for fertilizer, it is most probable that a tremendously increased tonnage of sardines would be taken and so manufactured as there seems to be an unlimited market for such fertilizer product.

Next to the manufacture of fertilizer, the most profitable process is the reduction of fish for oil. This practice through ill-advised action was permitted under certain restrictions by the 1925 act of the legislature, and if carried out on the extensive scale that prospects indicate, a serious condition in so far as the conservation of this supply of food fish is concerned may arise, as in the case of unlimited reduction for fertilizer, for it appears there is a large if not unlimited market for such fish oil.

On the other hand, the straight canning business apparently does not appear to be profitable to all of the canners. Certain canners have informed the undersigned that they are selling their canned sardines for about the cost, or less than cost, of production, and are willing to do this for the profit they are able to make out of the by-products, to wit, fertilizer and oil, which come from the offal of the fish canned and from the 25 per cent of the fish taken into the plant which is allowed by law.

In the early part of the biennium the division had difficulty in enforcing the laws of the state and regulations of the Commission prohibiting the unrestricted use of sardines for fertilizer, and a number of lawsuits were instituted which, in most instances, were successfully maintained and such unrestricted fertilizer manufacture was enjoined by order of court.

To secure uniform application and enforcement of this law the Commission made an order requiring each sardine canner to produce from every ton of fish taken fifteen cases of canned sardines. This would allow the canner to reduce to fertilizer and oil the offal of the fish canned, plus the full 25 per cent of the whole fish taken, which is the maximum amount allowed by law. Permitting the canner to can or

produce less than fifteen cases per ton would permit them to reduce into fertilizer and oil in excess of the 25 per cent of the capacity of the plant, as allowed by law, and would be contrary to the express duty and responsibility of the Commission to see such law enforced.

The law enacted restricting the use of food fish for fertilizer, the constitutionality and merit of which has been passed upon and upheld by our Supreme Court, was enacted to prevent the unlimited and indiscriminate take of sardines which would occur and thus deplete or entirely destroy the species. Whether it provides the most effective means of control is doubted, but as such conservation measure, it should be—if it is to have any force—strictly and impartially upheld.

Through statistics kept by this bureau, and probably on account of the desire of the canners to take as many fish as possible so as to realize a profit from the manufacture of fertilizer and by-products, it was learned there was a very large production of canned sardines during the season of 1926–1927 and 1927–1928. This unusually large production might have been avoided had canned sardines been the sole or principal objective of the canners, as there would have been less inducement to produce such large quantities of canned products without some more or less definite assurance that the market would consume it. However, and notwithstanding the reason, such unusually large production was had and the market prices of sardines were consequently unstable and poor.

During the past year two organizations of canners were formed—The California Sardine Export Association, organized under the Webb-Kenyon Act, for the purpose of fixing a higher and uniform price for sardine exports, and also the Sardine Canners Association of California, to represent the canners in other matters not dealing with the export trade. Previous associations of canners have been formed and represented the canners from time to time in their relations together and in their controversies with the Commission, but these were eventually disbanded. It remains to be seen whether or not the two new associations will be the means of better cooperation with and assistance to the Commission in upholding and enforcing the laws of the state to the end of assuring conservation, and consequently better stabilization of the industry.

Prior to the close of the biennium officers of the association above mentioned presented a request to the Commission for a modification of the order requiring fifteen cases of sardines to be produced out of every ton of fish taken, to twelve cases. It is doubtful, for the reasons above expressed, whether the Commission has any legal authority to modify their order to such extent, and for this if for no other reason such request was not granted, nor has the existing order of the Commission been modified in any way to date.

It is conceivable that the Commission may again have difficulty and litigation with the sardine canners, or some of them, to enforce the law in this particular, although it was hoped there would be an attitude of lawful observance on the part of each of the members of this industry, as well as a desire on their part to assist the Commission in every way in administering and enforcing the laws over which it has jurisdiction.

The division has assisted in efforts to prevent botulism in canned fishery products by contributing $15,000 a year to the Hooper Founda-

tion for Medical Research, under which investigations and inspections are made from time to time to place the canneries in a more sanitary condition and to insure the canned product is free from any germs or other poisonous matter.

In decided contrast to the very large sardine fishery, there is a salmon supply in the Sacramento River which is fast becoming extremely limited. Troll fishing in Monterey Bay is now about 10 per cent of what it was a few years ago. Attempts have been made from time to time to change the law permitting trolling, but to date have been unsuccessful. However, some radical changes in legislation will have to be made if this once very important commercial fishery is to be continued. It is proposed that during the coming year large plants of silver salmon will be made in the San Lorenzo River, in Santa Cruz County, and also in the Salinas River in Monterey County, at the mouth of which river this division is constructing an opening which was closed during the earthquake of 1906.

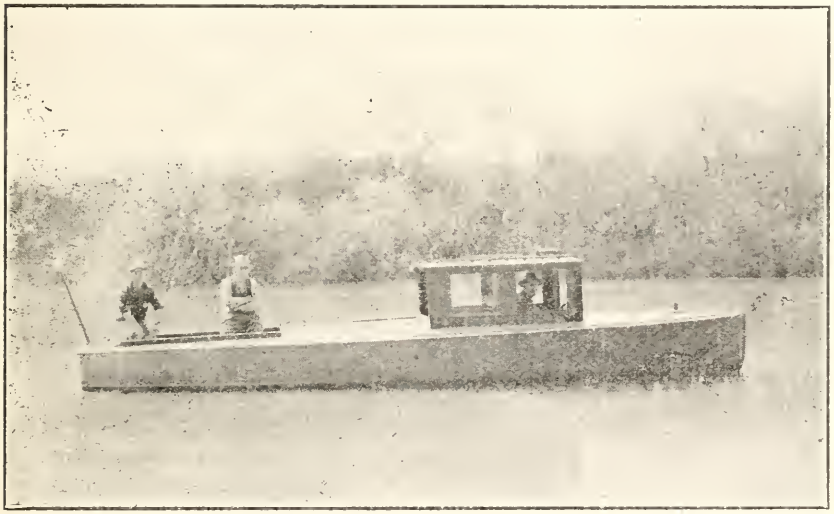


FIG. 8. New bay and river patrol speedboat *Rainbow*. Photograph by John O'Connell.

LEGAL BUREAU

Pursuant to the resignation of Mr. B. D. Marx Greene, December 1, 1927, the legal work of the Commission was assumed by the undersigned. Mr. Ralph W. Scott, assistant attorney, remained in that capacity.

Legal activities of the division cover quite a wide latitude and may be summarized as follows:

The rendering of opinions and advice to the deputies of the field force, other officers and employees of the division; district attorneys and others concerned with or interested in some legal phase of conservation, or fish and game law enforcement; the conduct of hearings on applications for permits, as well as hearings to revoke such permits; civil condemnation of nets and other seized paraphernalia; the conduct of criminal prosecution in the several counties throughout the state

where district attorneys request such assistance, or they refuse to or are unable to act; the prosecution of civil actions to enjoin unlawful operation of reduction or canning plants; civil actions for injunction and other remedies to enforce the construction of screens and fishways, and to enjoin pollution of public waters; defense of actions instituted against the division, the commissioners, or any employee thereof in their individual or official capacity, to compel or restrain certain acts, or for damages on account thereof.

The attached report of the Legal Bureau will show the very considerable extent of its activities during the past biennium.

THE FUTURE

There is probably no division of state government confronted with such difficult and uphill problems, and yet more subject to critical scrutiny, than the Division of Fish and Game.

The extensive growth in population and development of our state continues to circumscribe and draw upon the supply of fish and game in manifold ways. More than a half million license holders, whose numbers are rapidly mounting, finding less available and abundant the sources of their favorite sport and recreation, outspokenly demand more results from the fees they pay, many of these having divergent views of how such results are best obtained.

The division is now confronted with and probably always will face the impossible task of pleasing or satisfying all. Endeavor as we may, there will always be some to criticize and find fault. This should not, however, deter us from seeking and carrying out the course best calculated to bring the greatest good to the greatest number.

Conservation and restoration of wild life, to be effective, is dependent on certain fundamentals and is best accomplished by pursuing a definite program which should not be radically overturned or varied from except where new or changed situations arise, and then only after scientific experience and knowledge point the way.

With these general observations, the undersigned recommends that the present comprehensive working program of the division be continued, with principal effort being directed to eliminate lost effort and promote greater efficiency.

During the past year an effort has been made to keep in close touch with the large number of sportsmen's clubs and conservation societies throughout the state, and it is pleasing to report that on the whole these organizations are fully cognizant of the program and efforts being made by the division, and are enthusiastically giving their approval, support and cooperation.

Respectfully submitted.

EUGENE D. BENNETT,
Executive Officer and Attorney.

REPORT OF THE BUREAU OF FINANCE AND ACCOUNTS

By H. R. Dunbar, In Charge

Herewith is submitted the report of the Bureau of Finance and Accounts for the period ending June 30, 1928.

Since making our last report there have been certain changes in the work of this bureau due to the fact that at the last session of the legislature the Department of Natural Resources was created, embracing the divisions of Fish and Game, Forestry, Mines and Parks.

In the latter part of 1927 the accounting and bookkeeping of the Division of Fish and Game was consolidated with the accounting of the other three divisions into one office in the Department of Natural Resources. As a result of this consolidation Mr. J. F. Bell, accountant, Mrs. Othella Coleman and Miss Eva Pearson, all of the Division of Fish and Game, were transferred from the Bureau of Finance and Accounts to the Department of Natural Resources together with all bookkeeping and accounting records of this division. All correspondence relative to the claims are still handled through this office.

After the expense claims of the Division of Fish and Game have been audited and assembled into schedules for payment by the State Controller, the duplicates are brought into this office for payment from the funds of the revolving fund in order that the employees may be reimbursed for money expended by them, by which method they receive their money much sooner than waiting for payment to be made by the Controller. The revolving fund amounts to $16,000 and is used, in addition to paying the expense claims, for various bills upon which there is a discount to be taken advantage of as well as all postage and emergency items. The amount of the revolving fund is not sufficient to pay all of the expenses each month, consequently a number of the employees are forced to wait until a schedule of claims is paid by the Controller to reimburse the revolving fund sufficiently to meet the full amount of expenditures.

At the last session of the legislature, a deer tag license act was passed requiring all persons who hunt deer to take out a set of deer tags (which represents two tags) in addition to the regular hunting license, consequently an order for 149,800 tags was placed for the 1927 season and out of these, 110,960 tags were sold to hunters. Also at the last session of the legislature the hunting and angling license acts were changed whereby the fee for citizen hunting and angling licenses was increased from $1 to $2 each. The alien angling license was also increased in fee from $3 to $5, these increases taking effect January 1, 1928. Also an additional hunting license was created for persons under the age of 18 years at $1 each.

Licenses to take care of the 1928 seasons have been ordered from the State Printing Office and charged by the State Controller to this office, which is accountable to the Controller in the following amounts: Angling licenses $669,500, hunting licenses $749,000, deer tag licenses $150,000; market fishermen licenses $65,000; trapping licenses $6,500; fish packers' and wholesale shell fish dealers' licenses $3,500, making a total accountability of $1,643,400.

It is the duty of this office, upon receipt of the licenses, to make a thorough count of them at the time of being charged by the State Controller. The licenses are then distributed throughout the state by two methods: One is to furnish practically all of the county clerks in the state with hunting and angling licenses and deer tag licenses

who take care of the distribution in their respective counties and account for the sale of the same to the State Controller, making remittances direct to the State Treasurer and at the end of the license year, the unissued licenses are returned to this office where they are credited and the various accounts closed.

The other method is for the three offices of the Division of Fish and Game to sell direct to agents in various parts of the state as follows: The agents remit the full value of the licenses needed, in advance and the licenses are then sent out to them for resale to the sportsmen. The money is deposited in the bank in a special account known as the bond trust account. After the book of licenses has been sold by the agent, the stubs together with the applications are returned to the office from which they were purchased and at the end of each month the branch offices transfer from the bond trust account, the full value of such books returned and the money is placed to the credit of the state account. All moneys in the state account at the end of each month are remitted to the office of the cashier at Sacramento, the cashier making out a consolidated report and immediately remitting the money to the State Treasurer to the credit of the fish and game preservation fund.

The reason for the direct sale to agents by the Division of Fish and Game is that in certain counties the county clerks either do not handle the licenses for distribution or they are perhaps handicapped by local ordinances preventing them from retaining the amount of commissions received for the sale of the licenses and in some cases, as has happened in the past six months, county clerks due to certain conditions have declined to handle the licenses, making it imperative for the Division of Fish and Game to resort to a direct distribution.

In the past years this office has been greatly in favor of the county clerk distribution but owing to difficulties encountered in the past six months due to various county clerks desiring not to handle licenses any longer, and also a number of the county clerks being very negligent in the matter of making remittances and reports on old license accounts, the writer has come to the conclusion that unquestionably a direct distribution of licenses will be entirely satisfactory, in so far as the Division of Fish and Game is concerned. It will be possible, he feels sure, to have licenses on sale at all places necessary, and at the same time a more direct control of the funds will be had, as the moneys will be held in the bond trust account and turned over to the State Treasurer in due course of time as each particular license expires, whereas the experience now had with various county clerks is that it has been impossible to obtain final settlement on several of the 1927 angling license accounts and the 1927-28 hunting license accounts. Unfortunately, we had trouble with the county clerk of Inyo County but this, the writer is quite sure, was beyond that county clerk's control. About the middle of 1927 a number of banks in Inyo County closed their doors and at that time considerable money was in the possession of the county clerk as well as a number of his agents, which was on deposit with these banks.

At the last session of the legislature, an amendment was made to the License Sales Act reducing the amount of commission paid on the sale of all licenses, from 10 per cent to 5 per cent. At the time

of introducing this bill it was intended that it should become effective on January 1, 1928, at the time the increased fee was to become effective, but through an oversight the amendment did not specify the effective date and consequently it became effective on July 29, 1927, allowing commission on the sale of hunting and angling licenses which were at that time $1, for only 5 per cent. The commission on the sale of deer tags was allowed at only 5 per cent. When it was discovered that the reduction in commission on the hunting and angling licenses became effective on July 29, 1927, and the county clerks notified to that effect, practically all of them complained bitterly and a good many of them stated that they could not, on such a small commission, assume the responsibility of the distribution of licenses in their counties as they must pay all expenses necessary to the distribution and collection of money as well as at times assume any losses of licenses by their agents. Since then a number of the county clerks have refused to handle the licenses but the writer feels satisfied that satisfactory distribution in these counties is being obtained by selling the licenses direct to the agents, although quite a few of the agents have expressed the opinion that they could not advance their money for only a 5 per cent commission.

At the present time over half of the sales on hunting, angling and deer tag licenses are being made by the three offices of the Division of Fish and Game.

Due to the increased work in the three offices caused by the county clerks not handling as many licenses and on account of the creation of the deer tag license, the work has increased considerably, making it necessary to increase the office force in Sacramento by a messenger, and Miss Dorothy Nash in the Los Angeles office, who accounts for a very large part of the license sales, has a tremendous amount of work to do and it will not be long before it will be necessary to give her an assistant. Mr. J. J. Shannon in the San Francisco office, handling license matters, finds it necessary likewise to have assistance.

In a separate part of the biennial report there are statistical reports showing the sale of the various kinds of licenses by years, and it will be noted that the angling licenses in particular are showing a steady increase year after year, while the total amount of sales for the hunting licenses exceeds those of the angling licenses, but it should be borne in mind that persons under the age of 18 years are privileged to fish without a license, so it can be safely assumed that the actual number of persons who fish in the state is greater than the number who hunt.

It is the writer's opinion that it would be quite difficult to have proper distribution on as large a number of denominations of licenses as we now have and believes further that it would be just as well if the $2 hunting license applied to persons 16 or 18 years of age and those under that age be permitted to hunt without a license the same as persons under 18 years of age are permitted to fish without a license. It is the writer's opinion that boys under 16 years do not do any great amount of damage if they are allowed to carry a gun or hunt without a license, while it might be an incentive for more of them to go into the field with a gun and thereby learn the use of the gun and be better sportsmen as they grow older. It was evident in the last war that a great many men in the army had had absolutely no experience with firearms whatever, so if more of them were encouraged when boys to carry a gun this country would be more prepared in cases of emergency and so serve a double purpose.

REPORT OF THE BUREAU OF PATROL

By K. P. Allred, Acting Chief

October 1, 1927, a change was made in the organization of the Patrol Service. Mr. J. S. Hunter, who had been Chief of Patrol for several years, was transferred to another department and the writer was transferred from Captain of the Monterey District to Acting Chief of Patrol.

In February, 1928, the Commissioners issued an order making it obligatory upon the members of the Patrol Bureau to wear uniforms. A dark olive drab color was recommended and adopted. The uniform is required to be worn at all times except in extreme cases where it might be too conspicuous to violators and when working in very rough or wet places.

The Patrol Bureau is now being run as a separate unit of the Division of Fish and Game. It might be classed as the Police Department of the Commission, being run along the same lines and having the same relation to the other departments that the police force of a large city has to the other city departments; that is, the patrolling, policing and invesigating violations of fish and game laws.

In addition to having been active in the field on patrol duty, the deputies have cooperated with the Bureau of Fish Culture in the planting of trout fry in the lakes, rivers and streams. Captain O. P. Brownlow will submit a separate report on fish planting.

It is the opinion of the writer that, in the employing of new men, better results can be obtained by fixing the age of employment between thirty and forty. Of course, there may be exceptions to the rule, as in all other rules. It is also thought better results can be obtained in the protecting of the wild life of the state if deputies of the regular patrol are occasionally transferred from one section of the state to another. This system has been adopted by the present acting chief in a few cases and much better results are being obtained in these districts.

During the last duck season the Bureau of Patrol established a headquarters near Maxwell, Colusa County, for the deputies who had been assigned to duty in the rice fields, so they could have a warm place to change their wet clothes and have warm meals when they came off duty. A vigorous campaign was conducted against the market hunters, with the result that "drag shooting" and "bootlegging" of ducks and geese was reduced considerably below that of previous years.

It is also thought that with the experience gained during the last duck season, much better results can be obtained during the coming season. We also expect to apply the knowledge gained last winter in the handling of the duck question in the Colusa District to the same situation in Los Banos District.

During the biennium, 2317 arrests were made for violations of the game laws and 2073 arrests for violations of laws relating to fish, making a total of 4390 arrests. A total of $147,254.50 was assessed in fines, together with 8504 days in imprisonment. One hundred thirteen nets were seized during the biennium. These figures show an average of over six arrests per day and an average income from fines for the fish and game protective fund of $201.70 for every day of the two-year period.

At the close of the biennium, the Patrol Bureau consisted of 122 persons, divided as follows: One patrol chief, one assistant in the San Francisco office, twelve captains (one captain in charge of the fish planting and one in charge of volunteer deputies), seventy-nine deputies, one lion hunter and one stenographer. One assistant chief of patrol is in charge of the Los Angeles office, with two captains, twenty-three deputies and one stenographer.

We also have the following equipment: One 16-foot motor boat, with Johnson motor attached, at the Salton Sea; one 17-foot wooden boat, with Johnson motor attached, at Sacramento; the launch *Quinnat* at San Rafael, the speed boat *Rainbow* at Walnut Grove, the speed boat *Hunter* at Vallejo, one outboard motor boat at Napa, one outboard motor boat at Requa, three canvas boats, twelve Johnson outboard motors at different locations throughout the state, and two automobiles.

On August 1, 1927, the deer tag law went into effect. It is generally acknowledged that it has been a very material factor in reducing the number of illegally killed deer, besides giving the Commission a fairly accurate check on the number of deer killed during the open season.

It is most generally thought that there has been a marked increase in the game animals and game birds of the state due to increased efficiency of the regular patrol, the assistance of volunteer wardens, and the cooperation of the sportsmen and interested citizens of the state.

During the biennium, two conventions were held, one in the spring of 1927, which all but three members of the patrol attended, and the other in the spring of 1928, which was attended by the entire patrol. There is no doubt but that the members of the patrol derived much benefit from the instructions given at these meetings.

In November, 1927, Walter R. Welch, who had been field assistant to the executive officer in charge of volunteers, was appointed captain of volunteer wardens and placed under the order of the patrol chief. Captain Welch will submit a separate report covering the activity of the volunteer wardens.

I am pleased to be able to say at the close of this biennium there is absolute cooperation and harmony between the sportsmen's associations, the large commercial fishing interests and wholesalers, and the Patrol Bureau.

REPORT OF VOLUNTEER DEPUTIES

By WALTER R. WELCH, Captain of Patrol, In Charge

At the session of the state legislature held in 1927, section 642 of the Political Code, which section defines the duties of the Fish and Game Commissioners, was so amended as to provide that the Commissioners may from time to time employ such deputies, with or without pay, as they may deem necessary to strictly enforce the laws enacted for the protection and preservation of fish and game.

This section of the Political Code became effective July 29, 1927. Its operation automatically canceled the appointment of all former so-called "dollar-a-year" wardens, the appointment and activities of whom had been supervised and controlled by a special agent working out of the executive office.

Under the provisions of the law as amended each deputy appointed to serve without pay, except employees of the federal government, shall furnish the state with a surety bond in the sum of $2,500 for the faithful performance of his duties, the premium on the bond to be paid by the state out of the fish and game preservation fund.

As the system and rules established by the Commissioners governing the appointment and activities of the so-called "dollar-a-year" wardens, although having been in force for less than one year, had proven satisfactory and had been productive of beneficial results for the protection of fish and game and the enforcement of the laws, the Commissioners, in order that the Division of Fish and Game might receive the benefit of those who were willing to volunteer their services to the cause of fish, game and wild life protection and for the enforcement of the laws enacted for that purpose, have established a system and rules governing the appointment and supervising the activities of volunteer deputies, and has attached these deputies to the department of the regular patrol.

Under the system and rules governing the appointment of volunteer deputies of the Division of Fish and Game, a man must be recommended and his appointment sponsored by a regularly organized and bona fide fish and game protective association or club. The recommendation must be endorsed by the captain of the regular patrol of the county in which the applicant resides, and be approved by the captain of patrol in charge of the volunteer deputies.

The activities of the volunteer deputies of the Division of Fish and Game, except those who are in the employ of the federal government, are, under the system and rules that have been established by the Fish and Game Commission for their control, under the direction and supervision of the captain of patrol in charge of volunteer deputies, and are required to report monthly and to render an account of all of their activities, such as the number of hunting and fishing licenses checked, the number of miles of fields and streams patrolled, the number of arrests made for violation of the fish and game laws, and the amount of fines imposed, fish and game conditions observed while in the field, etc.

As the status of the volunteer deputies is the same as that of the regular patrol the rules that govern their activities are similar to those that apply to the regular patrol and are as rigorously enforced.

Under the provisions of the law as amended in 1927, the Commission has appointed 796 volunteer deputies. The appointment of 449 of these deputies was sponsored by bona fide fish and game protective associations and clubs located in various sections of the state, and the appointment of 347 was sponsored by the United States Forest Service.

The establishment by the Division of Fish and Game of a system and rules governing the appointment and supervising the activities of volunteer deputies in California is the first of the kind ever to be attempted in any state, has been more or less pioneering in nature, and in some respects is incomplete, due to lack of necessary time required to work out some of the problems.

At the present time the volunteer deputies of the Division of Fish and Game in twenty-three counties within the state have been organized and instructed in the discharge of their duties and are now working under the direction of captains, and in cooperation and coordination with the deputies of the regular patrol and are performing an exceedingly satisfactory service.

A brief and incomplete summary of the reported activities of the volunteer deputies during the past two years indicates that these deputies have checked 31,905 hunting and fishing licenses, that they have patrolled 336,152 miles of fields, streams and game cover, that they have arrested or assisted in arresting 487 violators of the fish and game laws, and that $14,358 in fines have been imposed. In addition to these activities on the part of volunteer deputies, 637 hunting and fishing licenses have been checked, 21,973 miles of fields and streams patrolled, 146 arrests made, and $5,540 in fines have been imposed as the result of the activities of county fish, game and forestry wardens who have been appointed volunteer deputies of the division in the southern part of the state.

The appointment and organization by the Fish and Game Commissioners of fishermen, hunters and outdoor lovers who are willing to contribute their services as deputies of the Division of Fish and Game to the restoration of sports afield and astream with gun and rod in California, without commercial, political or personal ties, or hope of reward, is undoubtedly the most comprehensive move and program ever undertaken for the protection and conservation of wild life in the United States. This movement represents a patriotic and unselfish endeavor to save for our children and for future generations that priceless heritage of nature—the fish, game and wild life of the state—in order that they may enjoy the health, recreation and happiness that only the great out o'doors can give them.

The volunteer deputies of the Division of Fish and Game of California have been drafted from and represent the highest ranks of citizenship within the state, many of them being nationally known, which insures the integrity and high standing of the organization.

Although less than two years have passed since the Fish and Game Commissioners of California established a system for the appointment and supervision of men who were willing to serve without compensation as deputies of the Division of Fish and Game for the protection and conservation of fish, game and wild life and the enforcement of the laws enacted for that purpose, the services that have been rendered by these deputies have been exceedingly satisfactory and have resulted in awak-

ening thousands of sportsmen and people who are lovers of the great out o'doors to a realization of the perils that are threatening the supply of fish, game and wild life of the state, and the necessity of cooperative action on the part of the sportsmen and the people in general in the work being carried on for the protection and conservation of fish, game and wild life and the enforcement of the fish and game laws, as well as the efforts being made for the restocking of the game fields and public waters by the Division of Fish and Game.

The action of the men who have, without compensation or hope of reward of any kind, volunteered their services as deputies of the Division of Fish and Game, and entered the fields for the protection and conservation of fish, game and wild life and the strict enforcement of the laws that have been enacted for that purpose, is certainly worthy of the highest commendation and surely deserves the hearty and united support and cooperation of all sportsmen and law abiding citizens within the state.

While it is pleasing to be able to report the success of the volunteer deputies, and the system and rules supervising and governing their activities, it is very apparent that in order that the funds expended to maintain these deputies may result beneficially to the cause of fish, game and wild life protection, and that the volunteer deputies continue to merit and receive the confidence, respect and support of the sportsmen and the people, it is absolutely dependent upon continued and constant personal supervision and the never ceasing stimulus afforded by directed effort that will tend to prevent the lessening of interest in the protection of fish, game and wild life, and the strict enforcement of the laws enacted for that purpose.

It is believed that the present bond required of volunteer deputies, viz., $2,500, is unnecessarily high and that a bond in the sum of $500 would be ample.

REPORT ON FISH PLANTING

By O. P. Brownlow, In Charge

For many years it was felt that we were not getting the best results from our fish planting. This was due to a method in use whereby the fish were shipped by train or delivered by truck to sportsmen's organizations or interested citizens who had made application for fish.

When the ones most interested, and those who had had experience, were in a position to handle the fish when they arrived, there was very little trouble; but in many instances business or other reasons kept these experienced hands away and the fish were sent out with inexperienced and uninterested men who would dump them in the nearest water, or would allow the fish to die on the trucks for lack of attention.

This great annual loss of fingerlings brought about a change in the planting policy of the Commission and on March 15, 1927, the patrol department assumed charge of fish planting operations. A supervising captain was placed in charge of the work, whose duty it was to assist the captains and deputies in making allotments for each district of the state, follow up train shipments and direct distribution from hatcheries by truck.

The captains and deputies during 1927 assisted and directed the planting of over 18,000,000 trout in the state with a very small loss considering the fact that the work was entirely new to many and the equipment was not complete.

In order that the planting work could be more efficiently handled, late in 1927 a truck was equipped with aerating apparatus similar to the equipment used on our railroad fish cars. This truck was not finished until late in the planting season but it was soon demonstrated that the theory was practical and fish could be carried longer distances with less loss and at considerably less expense than on trucks where an extra attendant was necessary to aerate the fish at all times.

This year another truck is being purchased by this department for fish planting purposes and with improved equipment more effieient work is expected.

FISH RESCUE WORK

The high waters in the San Joaquin valley during the spring of 1927 overflowed considerable area and when the waters receded thousands of valuable food fish were left stranded. Two part-time crews were engaged during the summer in rescuing and transferring to fresh water these stranded fish.

In addition to this work a crew rescued approximately 70,000 stranded steelhead trout in creeks of Lake County.

This spring additional equipment has been purchased, including 30 pack cans, 6 nets, dippers and thermometers, and it is hoped that at the end of the next biennium California will have sufficient fish planting and fish rescue equipment to properly plant and care for the fish life of the state.

REPORT OF THE BUREAU OF FISH CULTURE

By W. H. Shebley, In Charge

Conforming to the regulations and for the information of your honorable board, the Bureau of Fish Culture herewith submits a report on the operations for the biennium ending June 30, 1928, and recommendations for future improvements.

During this period we have not accomplished as much as we expected owing to seasonal conditions and unusual floods in some portions of the state and droughts in other parts. Repairs at the hatcheries have been made, new stations built and, as far as possible, we have kept up with the demand for an increased number of fishes to be planted in our waters. We are now operating twenty-five hatcheries and twelve egg-collecting stations and have recommended the establishing of several new hatcheries where experimental stations have been operated to determine the suitability of the water and other conditions for hatchery purposes.

The two fish distributing cars have given good service in making delivery of the fish to the lakes and streams that were stocked, and the trucks at the hatcheries have aided in the planting of fish.

During the last two years ending June 30th, there were distributed a total of 51,444,562 trout, and 26,728,590 salmon were liberated from the hatcheries and ponds.

We repeat the recommendation that we have made several times, viz, that a large number of trout of all species should be hatched and distributed in the lakes and streams of the state. There are suitable waters to be found for every species of trout and every effort should be made to increase the output.

REARING PONDS FOR SPAWN FISH

When we consider that the excessive fishing is rapidly depleting the supply of adult or egg producing fishes in our rivers, lakes and streams, the establishing of rearing ponds for the propagation of brood fish becomes more important each year. The Mt. Shasta Hatchery ponds established over twenty-five years ago have demonstrated the practicability and dependability of this method of producing eggs for all the hatcheries. These ponds are not affected by droughts or floods and we are assured of a regular supply of eggs each season to the limits of these ponds. We recommend that a system of ponds be established in different parts of the state so that an adequate supply of eggs can be had for practically all the hatcheries without depending on the uncertain conditions of seasonal changes and the ever-decreasing number of spawning or adult fish in the waters of the state. As soon as funds are available, a survey should be made by the Bureau of Fish Culture to locate suitable pond sites for the above purpose. Every year available and suitable sites are becoming harder to procure. The writer recommended to the Commission several times during the last fifteen years that suitable pond sites should be procured before they were taken over by private interests or for irrigation or power development.

PONDS FOR SPINEY-RAYED FISHES, CATFISH, ETC.

Owing to the great demand for the spiney-rayed game fishes, such as black bass, crappies, calico bass, blue gill sunfish, orange sunfish and perch, we recommend that a suitable site be obtained where these species can be raised in large numbers—several million each season—and distributed the same as trout. There are districts where this is not necessary, but information on this subject seems to indicate that there are many areas in the valley regions where these species should be more numerous. Probably before investing in this line of work a careful study and biological survey should be made, but from the evidence now at hand we believe that such a pond system would be a benefit in keeping up the supply of these valuable food and game fishes.

FIG. 9. Spawning operations at June Lake, where the supply of trout eggs is obtained for the June Lake Hatchery. Photograph by Burton Frasher.

We again repeat our recommendation that the use of fish eggs for bait should be prohibited, as the use of canned salmon eggs, particularly, cause the fish to be taken too easily and it is almost impossible to keep a supply of fish in our waters where salmon eggs and the eggs of other species are used to entice fish to gather in large schools where they feed ravenously on the eggs and where they are so easily taken. Natural bait and artificial flies should be the only bait allowed by law. Soon there will be no fishing for anyone if some radical methods are not adopted to prevent the taking of the fish so easily and often in numbers in violation of the limit fixed by law.

The legislature should arrange for the Commission to purchase the Klamath River canneries and prohibit any commercial fishing on the Klamath River.

During the last biennial period the following species and numbers of trout and salmon have been distributed:

Rainbow trout	16,065,185	Large lake	2,358,500
Loch Leven	9,375,460	Cut-throat	284,000
Steelhead	9,610,085	Black spotted	4,147,480
Eastern brook	5,535,340	Golden trout	821,000
Brown trout	3,906,219	Salmon	26,728,590

Except for a short period the streams have been unusually low and the fish have suffered accordingly; not only have they not had sufficient water in the streams, but the low water period has caused them to congregate in pools where they were easily caught as well as being the prey of their natural enemies. The legislature of 1927 enacted a law giving the Director of Natural Resources, with the consent of the Governor, the authority, when recommended by the Fish and Game Commis-

FIG. 10. Domingo Springs Holding Tank, as it appeared in February, 1928, when operations began. Several days must be spent in clearing snow away when mountain hatcheries are first opened.

sioners, to close any lake or stream in the state when it is deemed advisable so to do, to allow the fish to develop to a larger size or to protect lakes and streams that have recently been stocked. This was legislation that should have been passed years ago as inestimable good can be accomplished by closing streams and lakes to prevent them from being depleted of practically all fish life as well as to create nursery grounds where the young may develop before descending into larger bodies of water. Lakes may be closed so that additional spawning fish may be had and many other advantages to the fish life can be developed by closing certain lakes and streams.

We again recommend that all spearing of fish be prohibited in this state as it is a slaughter of the fish generally when they are on their spawning beds or on the way to the breeding grounds.

Following is a brief summary of the work accomplished at the different hatcheries and recommendations:

MT. SHASTA HATCHERY

The work of making the much needed repairs at this hatchery began on April 19, 1926, and was completed June 26, 1927. All ponds had the old board lining removed and replaced with new cedar planks and redwood posts. Posts were tied through to posts in adjoining ponds with strap iron. All walks between the ponds were widened and filled with earth. The old drains were removed from the ponds and new pipe drains put in. The pipe was from 8 to 16 inches depending upon the size of the ponds. Each pond has an iron gate valve at the end of the drain pipe to lower water when necessary, and are so arranged that each pond may be emptied without disturbing any other pond. Gate valves and pipe where it enters each pond were braced with concrete blocks set in the pond bank.

One concrete settling tank was built to supply water to Hatchery E. Also a concrete diversion tank was built to supply water to Hatcheries C and D. New 16-inch pipe lines were laid from the concrete tanks to the hatcheries with gate valves to regulate the water flow. Iron railings were placed around each tank.

Hatchery A had new supports and drains put under floor, and the inside and outside were painted, as well as the roof being repaired.

Hatchery B was entirely remodeled. New studding was put in where necessary, rustic outside and ceiled inside, new iron roof, and new doors. The building was also painted inside and out.

Hatchery C was also entirely remodeled with new studding and rafters wherever necessary. A new floor was put in, new rustic outside and the interior ceiled. A new iron roof was put on and new drains under the hatchery and new underpinning. The building was painted inside and out.

Hatchery D was built entirely new upon a different site. The building was ceiled inside, rustic outside and painted inside and out. The roofing is of iron. About half the hatching troughs are new.

Hatchery E was rebuilt with new studding and rafters where necessary, ceiled inside and rustic outside. New troughs and head troughs were installed as well as a new floor. New drains were put in and new underpinning under the building. The building was painted inside and out and new doors and windows put in. The barn has a new roof of corrugated iron and new rafters were put in where necessary.

Two new concrete septic tanks were built with outflow pipe to lower end of hatchery grounds. One new concrete settling tank was built to supply water to Hatchery E through a 16-inch pipe, and an iron railing put around the tank.

One new concrete diversion tank was built to supply water to hatcheries C and D. The water is conveyed through 16-inch pipes, and the tank is surrounded with an iron railing.

A new refrigerating plant and feed room was built on the site of Old Hatchery D. The refrigerating plant is a Cyclops ice machine with a capacity of three tons—one ton for ice and two tons for refrigeration. There is one cold room for storing ice and holding fish food, and one cooling room for keeping prepared food. The cooling plant is entirely automatic. The building has a concrete floor, and sills

around it. The feed room has a new motor installed, a new cauldron for cooking mush and a concrete cooling tank. The building has rustic outside and is covered with a corrugated iron roof.

A new power plant was built on a new site where all water can be used in ponds after passing over the waterwheel. The building is of concrete where the well is located and has a concrete floor. The walls are of rustic. The equipment consists of a Fitz waterwheel, a new generator, and all the necessary equipment such as grids and switches. Water is conveyed to the waterwheel through a 24-inch pipe. From the waterwheel it is diverted to ponds and hatcheries through 16-inch pipes.

A new fence has been built around the entire grounds of wire fencing and iron posts, with the exception of a short space on the west side where wooden posts were used in marshy grounds. The old wooden gates were all replaced with iron ones. All iron posts were set in concrete.

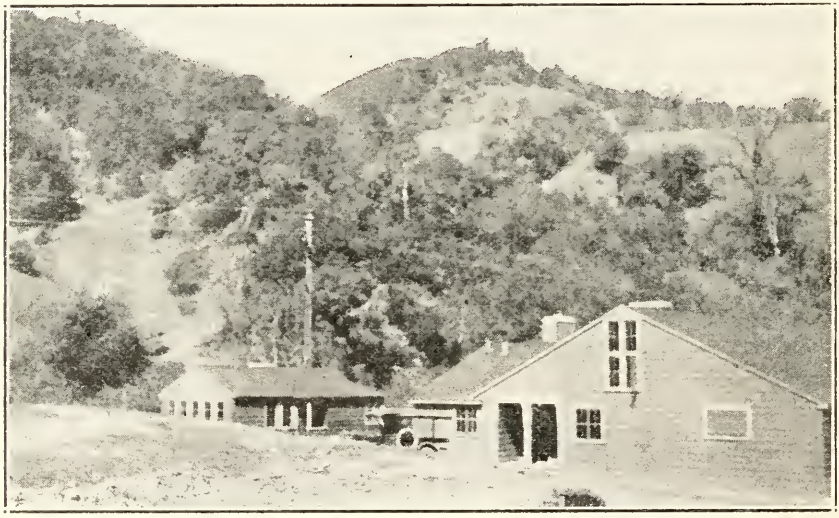


FIG. 11. The new Cold Creek Hatchery near Ukiah. This hatchery is taking over the work of the abandoned Ukiah Hatchery.

A new concrete walk was built from Hatchery A to the county road to replace the old wooden walk.

FALL CREEK HATCHERY

This salmon and trout hatchery has been operated during the last two seasons very successfully. The fish are always in good condition. There has been but very little trouble in raising fish at this station. The salmon reared in the ponds here do remarkably well and are all distributed in the Klamath River.

There were no improvements at this station under the special appropriation. But in the fall of 1926 heavy rains and high water washed out around the end of the building, making a bad hole, which was later filled in. The building was also painted inside and the flumes repaired.

CAMP CREEK STATION

This station was repaired in 1926 with new racks and stringers, but in the winter of 1926-27 the high water greatly damaged the plant. Since then a new concrete holding tank has been built and a new concrete apron placed across the creek under the racks and trap. New abutments of concrete were placed at the end of the racks in banks, a new concrete dam placed in the creek to turn water into the new pipe line and ditch to holding tank, and a new roof put on the cabin. The station is now in first-class condition, but a new cabin should be built to replace the old shack now being used.

HORNBROOK EGG-COLLECTING STATION

Under the special appropriation, a concrete apron was built across the creek and a concrete holding tank. Also a two-room cottage, which has an iron roof and box sides. During the winter of 1926-27, high water washed out the concrete holding tank and changed the channel of the creek to the west of the old racks. To repair this a new concrete holding tank was constructed, and a new concrete apron placed across the creek channel to connect to the old apron. A new wall was put along the west bank above the holding tank and racks to turn water from the bank. A new concrete wing dam was built to turn the water into the pipe line and a new pipe line was laid from the dam to holding tank. The piers of the racks are also of concrete.

BEAVER CREEK EGG-COLLECTING STATION

This station was practically all rebuilt during the fall of 1926. Plans were made for a permanent dam across the stream so that the water could be regulated by a series of splash boards between concrete piers. A concrete tank trap was built, cottages for the help, and all the necessary equipment installed. As Beaver Creek is one of the principal tributaries of the Klamath River, the expenditure necessary to make this a first-class egg-collecting station was necessary.

During the spring of 1927, although there was very high water for several days, no material damage was done to this trap or the piers. After the first installation of the trap, dam and cottages, there were improvements and unfinished work that kept one or two men busy all summer getting the station in permanent condition.

The early spring and winter of 1928 were dry and cold and the stream rose very little. The water was very cold so that the usual run of trout did not enter the stream. These conditions caused the trout to remain in the river and over-retention of the eggs took place. In consequence, there was very little natural propagation. On March 1, 1928, when the run of trout should be entering the creeks in large numbers, the water was as low as in October. During March there was an unusual and heavy rain that flooded the streams tributary to the Klamath River. While no great damage was done, the fish did not enter Beaver Creek as they would during a normal storm, owing to the roily water and drift that came down the stream.

The total egg take at this station for the seasons of 1927 and 1928 was 2,165,000.

With a return of normal conditions many more eggs can be taken.

BOGUS CREEK EGG-COLLECTING STATION

This station was repaired by the building of a dam across the creek. The concrete apron extends across the creek from bank to bank with concrete abutments at each bank and two concrete piers in the creek. The dam is composed of heavy timbers against the piers and abutments. A new concrete tank trap was constructed which includes concrete fish-run and holding tank. A new cottage was built with four rooms and a porch with rustic sides, ceiled inside, shingle roof and painted inside and out. All the repairs above mentioned were completed in September, 1926, but were part of the general improvements.

Since July 1, 1926, a suspension bridge was built across the creek, a septic tank put in for the cottage and a concrete wall was built along

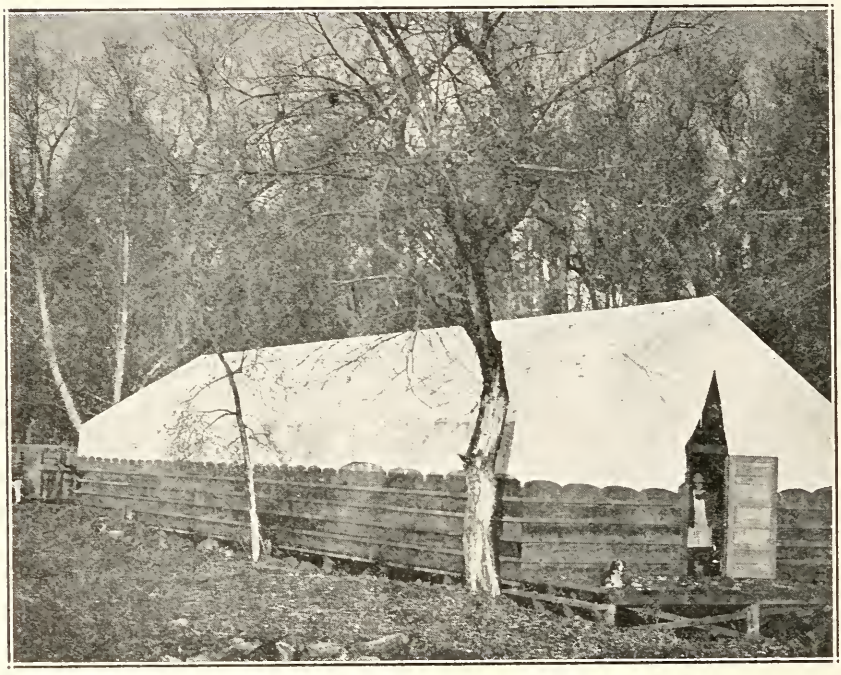


FIG. 12. Mormon Creek Experimental Hatchery in Sonoma, Tuolumne County. Photograph by Fred Leighton.

the creek in front of the cottage to prevent cutting of the bank. A pipe was laid from up stream to convey water to the holding tank at the trap. The road has also been repaired and a pipe line run from a spring to both the cottage and cabin to supply water for domestic purposes.

SHACKELFORD CREEK EGG-COLLECTING STATION

Under the special appropriation a concrete apron was placed across the creek under the upper racks with concrete abutments at each end and concrete piers in the creek. The same was done across the creek at the lower racks making two aprons and two sets of piers. A concrete holding tank was built and the levee on the west bank was built by

team and scraper piling up the earth and sand. On the east side of the creek from the lower racks to the county bridge, a wall was built of concrete to keep the creek from overflowing and cutting the bank. A road was built from the county road to the station by removing the brush and filling in the low places so that it is easily accessible. All this work was finished in October, 1926.

During the winter of 1926-27 there was very high water, wrecking both the upper and lower racks by upsetting the concrete piers and breaking up the concrete aprons. Repairs were made by abandoning one rack and then placing a wide apron across the creek with concrete posts. At the end of the apron a concrete holding tank was built. The wall on the east side was extended about fifty feet to the new bridge over the creek and the wall raised to prevent high water from overflowing. On the west side of the creek, a wall was run of concrete and

FIG. 13. San Gabriel River Holding Tanks. Better distribution of fish is expected as a result of a number of holding tanks of this type which have been built in various parts of the state.

extends from the holding tank to about five hundred feet above the county road. It was made with iron posts driven into the ground and tied together with reinforcing iron, and the concrete was poured around this. This work was done in October and November, 1927.

BURNEY CREEK HATCHERY

During the fall of 1925 surveys and plans for the establishing of a hatchery on Burney Creek were made. It was agreed that this hatchery was to be constructed by the Pacific Gas and Electric Company in lieu of fishways over their high dams in Pit River, with the exception that a salmon egg-collecting station was to be built at Hagan Flat or at some other suitable site where the eggs of the salmon could be collected from the run that ascends Pit River that would be prevented from ascending

to their former spawning grounds. This work on the salmon station has been held up until it was demonstrated that enough salmon would ascend the river to justify the expense of having the racks, traps and small hatchery installed if the road to Burney Creek Hatchery was not built to the site or the roads through the flat woods country were not passable. An examination made this spring indicated that there is a run of salmon in the spring months that ascends the river, but they do not spawn until late summer or fall. Therefore the Commission is justified in demanding that the power company construct racks and traps this fall so as to have them in readiness for next season's operations.

We understand that there will be no further developments by the power company for several years, so we would recommend that racks and traps be installed by the power company at the dam known as Pit 4 dam. The salmon eggs could be collected at this point and conveyed to the Burney Creek Hatchery and the resulting fry carried by truck or over the tram railroad to points below the dam and there planted.

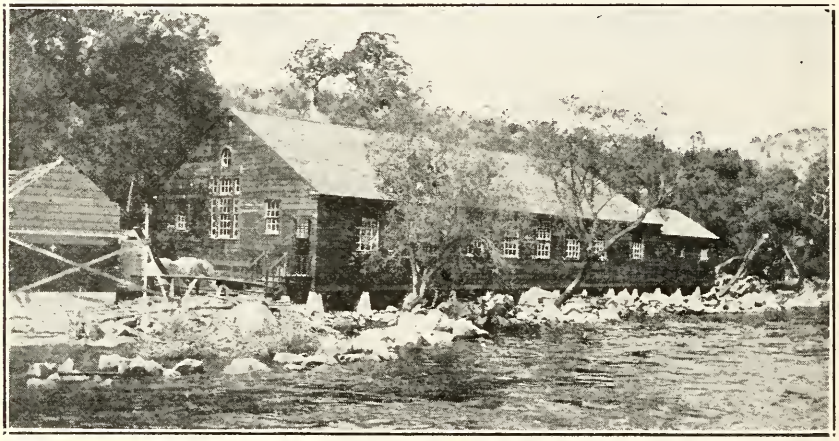


FIG 14. The new Kaweah Hatchery at Hammond, which has replaced an old temporary structure. Photograph by Edward Clessen.

Burney Creek Hatchery is now in operation. The extremely high water during the latter part of March, 1928, washed out the pipe line that supplies the hatchery with water and it was a difficult matter to make temporary repairs. In consequence the fish that were then in the hatchery suffered from a shortage of water as well as not being able to feed for a period of over a week owing to the roily conditions of the water and other unavoidable conditions, consequently there was a loss of nearly 40 per cent before the fish were in a normal condition again. As soon as the fish are all distributed, permanent repairs must be made on the supply pipe.

MT. WHITNEY HATCHERY

The same conditions have prevailed at this station as in former years. The fish make a rapid growth and are always in good condition at the time of distribution. The usual repairs to maintain the hatchery in

good order have been made and the grounds improved by planting of additional flowers, trees and shrubs.

This fine stone building located on the arid foothills above Independence with its ponds and green lawn, is a beautiful sight to the tourists on their way across the desert wastes that they must cross before reaching the wooded sections of northern Inyo and Mono counties where thousands of recreationists spend their vacations camping, fishing and hunting.

With the ever increasing demand for trout and the many barren lakes in the southern High Sierra to stock, and as the capacity of the Mt. Whitney Hatchery has been reached, I deem it advisable to build an auxiliary hatchery in that region to be under the same management as the Mt. Whitney Hatchery.

BIG PINE CREEK

Big Pine Creek Basin affords several sites near the town of Big Pine where, if the water is suitable, a hatchery could be built, as well as

Fig. 15. The new Burney Creek Fish Hatchery.

ponds for the rearing of adult fish or breeders for the purpose of furnishing eggs to the hatcheries in that section. I recommend that as soon as funds are available that a survey be made and an experimental hatchery set up to determine the suitability of the water for hatchery purposes and if all conditions are good, that a permanent hatchery and pond system be established in the lower altitudes of Big Pine Creek Basin.

COTTONWOOD LAKES GOLDEN TROUT EGG-COLLECTING STATION

This station furnishes all of the golden trout eggs hatched at Mt. Whitney Hatchery. The average number of eggs collected annually from Middle Cottonwood Lakes has been 450,000. The lake has been so heavily fished that it was deemed advisable to recommend that it be closed to fishing for a number of years or permanently so as to furnish a supply of golden trout eggs for the hatcheries. This was done by a

closing order on the 11th day of April, 1928. This will insure an adequate number of golden trout for all the lakes and streams in which this species will thrive.

We have recommended in our budget for the biennial period beginning July 1, 1929, and ending June 30, 1931, the building of a permanent cabin and its equipment at this station. Heretofore the egg-collecting crew camped out and had to operate under adverse conditions that were often very difficult as the lake is situated at an elevation of approximately 12,000 feet above sea level. A comfortable cabin should be erected for the accommodation of the help, as no doubt in a few years the output of golden trout eggs will be increased by the protection of the spawners, and a large number of this species must be planted each season as there will be more of this species caught when the public learn of the results obtained by stocking the barren lakes. The fry planted from Mt. Whitney Hatchery are now thriving in many lakes and streams, particularly in Desolation Lake, Duck Lake and the Dusey lakes. They are reported as thriving in Dorothy Lake, Virginia, Treasure, Genevieve, Morgan and Sherwin lakes, situated in the High Sierra, north and west of Bishop. These fish were hatched at Mt. Whitney Hatchery and the majority of them planted by members of the Rainbow Club of Bishop. They thrive only in high altitudes where the water is pure and cold and free of any organic matter that will in any way pollute the waters. The golden trout have been successfully introduced in the lakes and streams of the upper San Joaquin River and other waters in the southern High Sierra range. Years ago many adult fish were distributed in barren lakes by the deputies from the Fresno office. In many of the High Sierra lakes aquatic plants and insects should be introduced to furnish an abundance of feed for the golden trout that are being planted, as well as to introduce the same into waters already stocked.

RAE LAKES EGG-COLLECTING STATION

These lakes are producing but very few eggs. During 1926 the station was not operated. The season of 1927 being one in which the collection of eggs from wild fish did not open favorably, we opened the station at Rae Lakes in an effort to collect a larger number of eggs if possible. The crews were sent to the lakes the latter part of June just as soon as they could cross the pass and reach the lakes. The station was closed on July 24th as the small run of adult fish was over. The total take was only 60,000 eggs.

After the introduction of aquatic plants and insects into Rae Lakes, a number of years ago, the condition of the fish improved, but the excessive fishing soon depleted the supply, although it is a fish preserve. Recommendations were made in our last biennial report that this lake be posted and the law enforced. It is at an altitude of 10,700 feet above sea level and would require the services of a warden during the entire season to prevent the anglers from fishing and it is doubtful whether the number of fish that the lakes would furnish will justify the expense.

FERN CREEK HATCHERY

This hatchery was built during the summer of 1926 and produced very fine vigorous fish that are distributed in June Lake, Gull Lake, Rush Creek and the lakes and streams of Mono County. The average

output of fish for the last two seasons has been approximately 1,000,000 fish. The fish distributed from this hatchery are showing up in large numbers in the waters where they have been planted. Fern Creek Hatchery was first operated as an experimental station during the season of 1925. The resulting fry were planted in the lakes and streams in the adjacent district. All of the plants from this station have been successful.

FIG. 16. The new Fern Creek Hatchery, as it appeared in the spring of 1927.

RUSH CREEK EGG-COLLECTING STATION

Since this station was established in 1925, it has furnished an average of 2,000,000 eggs each season. Despite the many persons fishing in Grant Lake the black-spotted trout appear to be increasing. The take of eggs from Rush Creek Station during the spring of 1928 was 3,000,000.

GULL LAKE

We collected a total of 2,050,000 eastern brook trout eggs from this lake during the two seasons just passed. During the fall of 1926, 1,100,000 eastern brook trout eggs were collected. This lake is holding up very well considering the number of fish caught there each season by the anglers.

WALKER RIVER EXPERIMENTAL HATCHERY

An experimental hatchery was established on Walker River, Mono County, during the spring of 1928 to test the water to determine whether or not it is suitable for hatchery purposes. A tent and troughs were installed and 250,000 eggs will be hatched and a practical demonstration made before recommending any permanent work. The station is located on the Little West Walker River, 60 miles from Fern Creek Hatchery, on forestry land.

If this site is not suitable, we recommend that experiments for a permanent hatchery be made in Alpine County where four river systems

as well as many lakes can be stocked. During the fall of 1928 we will have a survey of the Alpine region made, as it is only a question of time when the Alpine County region will require a large hatchery, as the Mono County hatcheries can not adequately supply this district.

JUNE LAKE

June Lake, a barren body of cold pure water prior to 1921, was first stocked with steelhead trout in 1921. During 1926, the fish had developed to such a size that egg-collecting work was planned and successfully carried out. The first take of eggs exceeded 1,000,000. During 1927, 1,200,000 eggs were collected, but the rush of anglers to this lake on the opening day, May 1, made it impossible for our crews to seine up the fish, so the egg-collecting work was given up shortly after the season opened. With the opening set for June 1 by the last legislature, more eggs can be collected and better fishing afforded the anglers as a greater number of fish can be hatched and planted each season.

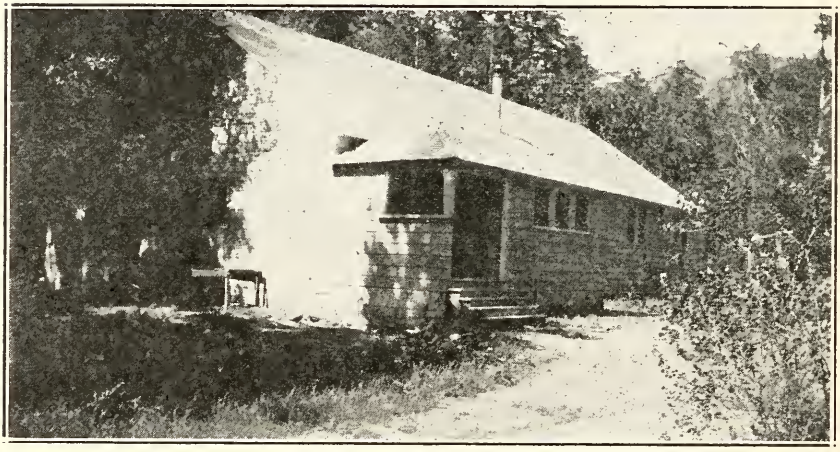


FIG. 17. The new Big Creek Hatchery, built to handle the work in Santa Cruz County. The old Brookdale Hatchery is now utilized for experimental work. Photograph by C. L. Frame.

CLEAR CREEK HATCHERY

This hatchery has been operated the same as in the past few years. In addition to the fish raised in the hatchery, ten rearing tanks were constructed to hold the surplus fish. This hatchery is run in conjunction with Domingo Springs Hatchery on the North Fork of the Feather River above Chester. Both of these hatcheries should be abandoned as soon as funds are available for the construction of a large hatchery in that vicinity. There should be a large hatchery erected on a site where a suitable supply of water can be obtained. This hatchery should be large enough to raise fish for the entire Almanor Basin, as well as for the lakes and streams in the Lassen Park.

Surveys should be made at an early date, and if conditions are found suitable, an experimental hatchery should be established this fall and operated during the summer of 1929.

DOMINGO SPRINGS HATCHERY

This station is old and in a very bad state of decay. The usual number of fish have been raised in this hatchery and in spawning tanks. As soon as possible this old hatchery should be abandoned and all the operations carried on in a modern hatchery to take the place of the Clear Creek and Domingo Springs hatcheries. These stations were built during the war when the funds of the Commission were very much depleted and were only temporary affairs to begin with. They should be abandoned if possible, this fall and a temporary hatchery established so that the output of fish can be handled in a temporary hatchery until funds are available for the construction of the large centrally located hatchery near Lake Almanor.

We recommend the establishing of a hatchery in Sierra County on one of the tributaries of the North Fork of the Feather River, as this region is heavily fished and difficult to stock from the other hatcheries. An experimental hatchery should be erected as soon as funds are available for this purpose on some tributary stream of the North Fork of the Yuba River. A hatchery in this location would not only furnish fish for the North and Middle Fork of the Yuba River, but for many lakes in this region that should be stocked annually. We recommend that as soon as funds are available that a hatchery be established in this district.

WARNER CREEK TRAP STATION

The usual number of eggs were collected at this station. A permanent rack should be installed in the river below the mouth of Warner Creek so that all the spawning fish could be taken at one place.

BUTT CREEK TRAP STATION

The racks have been installed each season and considerable work done to make this a good egg-collecting station, but owing to the fluctuating head of water from the Lake Almanor tunnel, the results were not satisfactory. In main Butt Creek the run of fish is not as great as in former years as the fish attempt to follow the larger stream coming from the tunnel and they are difficult to catch when the tunnel is flowing a full head. The fish that ascend from Butt Lake are diminishing in numbers owing, no doubt, to the heavy fishing.

OTHER EGG-COLLECTING STATIONS IN LASSEN PARK AND ALMANOR DISTRICT

Our foreman inspected Butte Lake in Lassen National Park, as well as the intake of Manzanita Lake to ascertain if eggs could be collected from these lakes. No results were obtained there this spring, but it is possible to collect eggs from some of the fall spawning species this fall and winter.

FEATHER RIVER HATCHERY

This station, established during 1924 and first operated in 1925, has been a success. There has been some minor improvements made such as installing a pipe line to furnish a domestic supply for the residence of W. A. Adams which was receiving the water directly from the hatchery discharge. During the high water caused by the sudden flooding of the streams in northern California during the latter part of

March, the pipe line supplying the hatchery was carried away and the crew, with great difficulty saved the fish in the building by aerating the water with dippers and furnishing a supply from the creek, while the foreman and one assistant worked for hours in the night to install a temporary flume to connect up the water supply that had been cut off by the flood. Luckily, there was not a very great loss of fish, but this is only one of the many instances where the hatchery crews have difficulties to overcome during floods, and the inclemencies of the stormy season, while collecting eggs and operating hatcheries.

WAWONA HATCHERY

The usual conditions prevailed at this hatchery during the last two seasons. Owing to algal growths and other conditions the fish have to be planted early. They make a rapid development during the first three months and should all be planted by the first or not later than the tenth of July. If it is deemed necessary to hold the fish in this section to a later date, a hatchery should be established on Alder Creek or a pipe line installed to bring the water from Chilnualno Creek to a flat on the opposite side of the river from Wawona. The Wawona Hatchery was built thirty-two years ago and there has only been one or two seasons during all these years when there was not some trouble among the fish after the first of July.

YOSEMITE HATCHERY

This hatchery, located in the Yosemiate National Park, was built during the fall of 1926 and finished in time for the spring eggs in 1927. During the seasons 1927 and 1928 the following number of fish have been raised in this hatchery:

Rainbow	195,000	Steelhead	966 000
Eastern brook	91,000	Black spotted	245,000
Loch Leven	298,000		

The station consists of a hatchery building containing 52 troughs, foreman's cottage and a cottage for the help. An aquarium to display the different species of trout is now being constructed in connection with the hatchery and plans are made for exhibition ponds in which will be placed trout of different species and ages. There is a constant influx of visitors at the hatchery, and there is no more popular place in the park for the visiting tourists than Yosemite Hatchery.

MORMON CREEK HATCHERY

In the fall of 1927 a site for a temporary hatchery was selected on Mormon Creek 4½ miles from Sonora, Tuolumne County. The water used in the hatchery experiments has its source in a tunnel that was run in the mountain below Columbia to tap an ancient gravel channel. Tests proved this water to be free from minerals injurious to fish and as it came from a tunnel over one mile in length several hundred feet from the surface, it was of a uniform temperature that would produce an excellent development in the fish.

A lease was procured for a site and we were assured that the water supply would be constant. Thirty troughs were installed and during the early winter, eastern brook and Loch Leven eggs were shipped to the hatchery and installed under a tent. The eggs hatched in good condition and they made a rapid and healthy growth. During the

spring, rainbow and steelhead eggs were shipped to the hatchery and all species thrived and made a fine growth. The fish grew so rapidly that an early distribution of the surplus fish was necessary. Later in the season six holding tanks were installed to hold the surplus fish and to give them an opportunity to grow a size of 3½ or 4 inches before planting. The total number of fish hatched at this station is as follows:

Eastern brook	70,600	Rainbow	246,700
Loch Leven	41,000	Steelhead	251,200
Brown	85,750	Black spotted	95,200

KAWEAH HATCHERY

This hatchery was installed under a tent in 1919. Good results have been obtained if the fish are planted early in the season. The water from the East Fork of the Kaweah that is taken from the discharge from the Southern California Edison Company's power house produces fine, healthy fish until midsummer or whenever the growth of algae and micro-organisms develop in the water and then the fish do not thrive as well as they should. The water from the East Fork is the best water to be found in all the Kaweah River system. Some years the fish can be held all through the season until late in the fall, but as a matter of getting best results, the fish should be planted early in the season as they make a rapid growth during the first three or four months of the spring and summer. During the winter of 1927 and spring of 1928 a permanent hatchery with 50 troughs, and cottages for the help were built and are now in operation.

KINGS RIVER EXPERIMENTAL STATION

Early in March, 1928, plans were made to operate an experimental hatchery on Kings River about 35 miles east of Fresno. This is a centrally located site for the distribution of fish for the Upper San Joaquin River and tributaries, Kings River and tributaries, and many lakes in the high range from General Grant Park to West Fork of the San Joaquin River. Considerable expense and labor were required to construct a diverting dam in Kings River as the river does not have a constant flow and the temporary dam had to be raised and made as tight as possible to hold the water to a level where it would enter the head of the intake for the hatchery.

The water to date has proven good for hatchery purposes, and if it continues to hold out during the remainder of the season, we will, after one more season's operation, recommend the construction of a permanent hatchery in that section. The Fresno County Sportsmen's Club has assisted us as far as they could, and we also received many favors from the San Joaquin Light and Power Corporation.

KERN RIVER HATCHERY

It was decided to carry on an experiment on Kern River to determine whether the water from the main river, after passing through the power house about seven miles above Kernville, was suitable for hatchery purposes. The lumber of this new experimental station was on the ground by the first of October, 1927. Mr. James Vogt, an experienced fish culturist, was placed in charge.

A frame was built, over which a canvas was spread to make the hatchery. It was our plan to hatch eggs from the fall spawning fishes,

as well as from the spring run. During the latter part of July, 1927, Dr. George A. Coleman, the biologist, accompanied by one of our field men, made a preliminary survey for an experimental hatchery station above Kernville. The result of their investigation is in accord with previous surveys made by the head of the Department of Fish Culture several years ago. A special report and recommendations on this survey was forwarded to the executive officer. Briefly, we recommend that an experimental station be operated under a tent for one season's hatching during the winter and spring, and plant the fish in Kern River. The troughs and hatching equipment was made permanent so that if the water was not in good condition to raise fish, the equipment could be moved to some more favorable locality.

Shortly after the Loch Leven and eastern brook trout were swimming up and feeding, they became effected from the water moulds and algae in the water. The rainbow and steelhead trout were also soon affected.

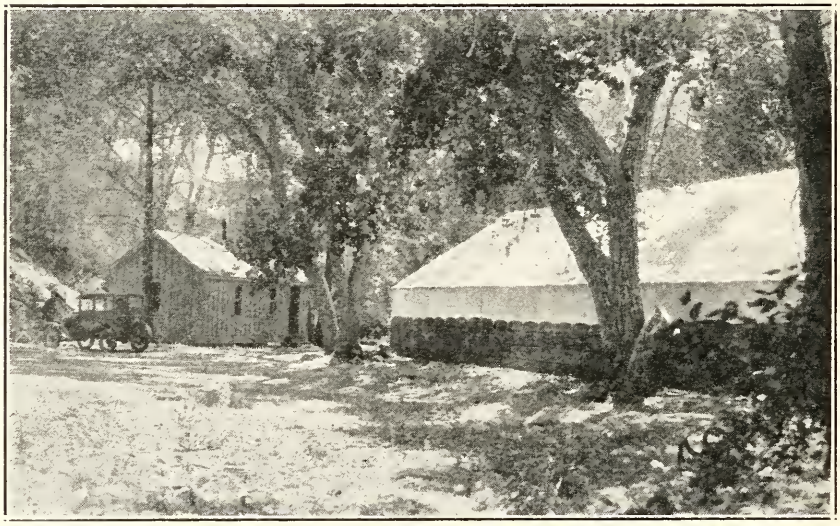


FIG. 18. View of the Kern River Experimental Hatchery from northeast.

A biological and pathological study was made and every effort made to remedy the trouble, but to no avail. The algal growths were very deleterious to the fry, causing gill diseases as well as lesions on the bodies. The fish were removed from the hatchery during June and placed in the ponds of the Kern County Sportsmen's Club, where it was hoped that by giving the fish more space they would improve, but there was no change for the better. The loss was very great both in the hatchery and in the ponds from the same causes. The tributary streams below the intake of Kern Power House No. 3 are all too small for a hatchery supply. The condition of Kern River below the discharge from the power house is worse than when the water was studied sixteen years ago, as it now passes through a fourteen-mile tunnel where the spores of the algae and confervae grow on the sides of the tunnel and cause a greater amount of these growths in the water than years ago.

During the latter part of April and the first part of May, Dr. George A. Coleman made a special study of conditions at Kern River Hatchery and we quote from his report as follows:

> "A thorough examination of this water was made from the intake at the head of the ditch, through the flume, settling tanks and head troughs and hatching troughs. The ditch was found to be literally alive with blue green algae of several species which caused a disagreeable odor. This algae caused a heavy growth on the sides of the tanks and troughs and a scum or mould formed. No matter how often it was removed, a new growth would develop in 24 hours after a thorough cleaning. The fish were found to be suffering from a heavy infestation of the gills with algae, fungus, and a peculiar desmid (Ankistrodesmus) which is finer than a cambric needle. It penetrates the gills and causes an irritation that is followed by a bacterial infection that soon causes death.

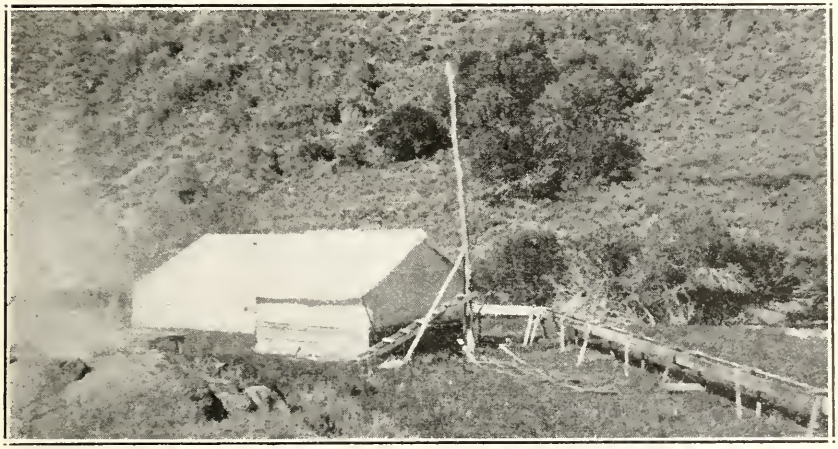


FIG. 19. West Walker River Experimental Hatchery. Typical of experimental stations is this one, a tent with eight troughs. Photograph by George McCloud.

> On a great many fish in the last stages, a peculiar amoeboid protozoan parasite was found on the gills by the hundreds, seemingly eating the algae, but also obtaining blood from the gills."

The above shows the general condition of the water in Kern River during the summer months. This season, 1928, the algal growths started unusually early. The writer has examined the water several times during the summer and fall in years past and found the algae in great quantities but owing to the passage of the water through the tunnel, together with the dry season, it was worse this season than in former years. It never was considered good water for hatchery purposes. Often persons not familiar with fish cultural operations, get the idea that because trout are found in a stream the water is good for hatchery use. This is not the case, particularly in California where we have such long dry seasons that affect the streams.

It was hoped the fish could be held until large enough to plant by using ordinary remedies, but owing to the drought and other conditions, the fish nearly all perished. We are still holding a few to finish

up our experiments, but from all the data gathered and experience had in that locality, we recommend that the station be abandoned and the equipment shipped where water conditions are better and where some results can be obtained. There is no stream anywhere in the Kernville section that is in condition to be used as a hatchery supply. It is useless to plant any fish in Kern River, in the lower reaches, for fish will not live in the main river during the summer months. Years ago there were some trout in the vicinity of Kernville. They would descend the river in the winter and spring, but they do not do so now. The lower reaches of Kern River can be stocked by the installation of tanks at the site of the last hatchery and the fry transported from some one of the other hatcheries, after the water in Kern River has cleared of the algae growths, that generally disappear after mid-summer.

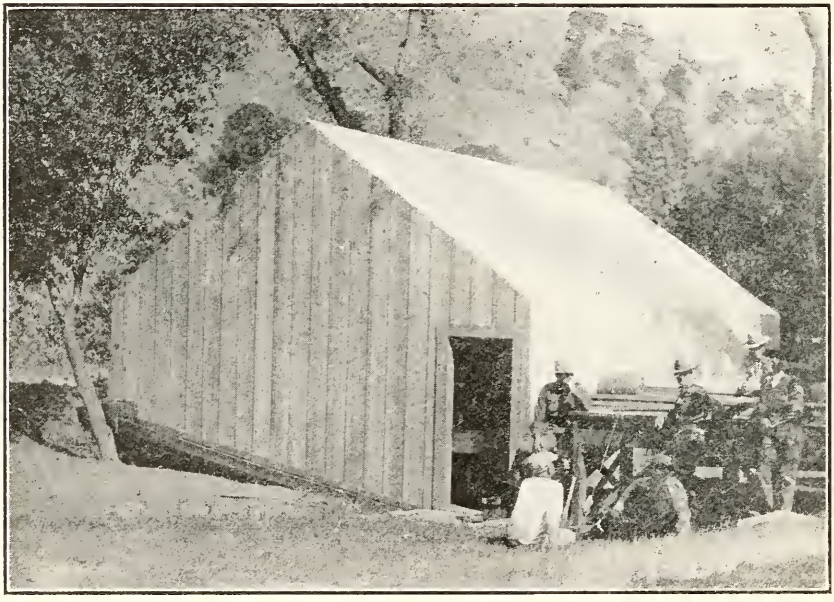


FIG. 20. Kings River Experimental Hatchery. Photograph by E. G. Grimes. June, 1928.

The upper reaches of the river can be stocked with fish from Mt. Whitney Hatchery by pack train carrying the fish to the upper reaches from the railroad between Mojave and Inyokern and probably over other trails.

BEAR LAKE HATCHERY

While conditions were not as favorable during the last two seasons as in the past years owing to the low condition of the water in Bear Lake caused by the drought, our crews were successful in collecting 4,500,000 rainbow in 1926; 2,000,000 in 1927, and 1,700,000 in 1928.

This number of eggs to be collected from Bear Lake is remarkable, when we realize that there are thousands of bass in this lake to prey

on the trout, as well as low water conditions in the creeks tributary to the lake.

In 1927 the water in the creeks was very low and during the spring of 1928 some of the creeks did not run any water and the most important stream, North Creek, ran such a small head of water that the fish could not ascend it in great numbers. The majority of the spawn fish were collected from Kid Bay by the use of a small seine.

NORTH CREEK HATCHERY AND EGG-COLLECTING STATION

This hatchery was not operated during the spring of 1928 as the water was too low to take any chances of placing eggs in this station. All eggs were taken directly to Bear Lake Hatchery and hatched. During the season of 1927 we used the North Creek Hatchery to eye the eggs as well as to hatch 600,000 fish that were later distributed in the streams of San Bernardino County.

Owing to the light rain and snow fall in the Bear Lake region and the demand for larger fish for distribution purposes, we were instructed by your honorable board to establish tank systems in which to hold the

FIG. 21. The new Santa Ana station. Here trout are held to age before planting in the waters of southern California. Photograph by Marion Lamb, June, 1928.

surplus fish from Bear Lake Hatchery; so early in June a site was selected on the San Gabriel River at Coldbrook Camp for a tank station, and after considerable delay a site was found on Forsee Creek, a tributary of the Santa Ana River, for another tank site.

THE SANTA ANA TANK STATION

These receptacles for fish were constructed during June, 1928. They consist of ten tanks with a capacity of approximately 50,000 fish, each of an average size of 1 to $1\frac{1}{2}$ inches when first placed in the tanks. As they grow larger they must be planted so that the tanks will not be overcrowded. At the last of the season the remaining fish should average four inches in length.

SAN GABRIEL TANK STATION

At the time construction work was being carried on at the Santa Ana Station, we had our crews busy at Coldbrook Camp on the San Gabriel River, twenty-five miles northeast of Los Angeles, where ten tanks and a number of troughs were installed. Both the San Gabriel River and Santa Ana stations are situated on National Forest Reserve lands. These stations are built of temporary material with cabins for help, and will relieve the situation in southern California until funds are available to establish permanent hatcheries. Then the tanks and small modern hatcheries can be built to furnish trout for the streams of southern California.

FORT SEWARD HATCHERY

The usual successful operation of this station has been carried on during the last two years. The station has been generally repaired and many improvements made. A bridge was built across Fort Seward Creek below the hatchery and a small truck purchased so that the supplies for the hatchery, as well as the provisions, etc., for the superintendent and a crew could be hauled with a small truck. Several years ago the bridge on the road from Alderpoint to the hatchery and the bridge on the road between the hatchery and the railroad were carried away by high water. A cable and tram was installed with a gas engine for power to convey the fish cans, egg cases and supplies to the hatchery. This was installed as there was not sufficient funds available at the time for the construction of the bridge, purchasing of a truck, and repairs to the road. The tram cable system was a slow and tedious method of operating. It took a great deal of patience and hard work to take even a small shipment of fish from the hatchery to the railroad. The cans, after being filled, were placed on the skip and lowered down the hill to a point where they were transferred to a car and conveyed by rail a few hundred feet, then placed on an old four-wheel truck to the railroad another couple of hundred feet where they were placed on the train and sent to their destination.

We mention these things to demonstrate the many difficult and arduous tasks hatchery men have to endure to make a success of their work. They seldom complain, but conscientiously carry out the work necessary to make a success of fish culture. The Fort Seward Hatchery is in an isolated place, but is situated on the only stream along the line of the Northwestern Pacific Railroad suitable for hatchery purposes. There are a number of larger streams, but the condition of the water is not good for hatchery use. The fish in this hatchery always make a rapid growth, and are in excellent condition when planted. During the latter part of the season, the water gets low in the two streams that furnish the hatchery so that the majority of the fish have to be planted before the latter part of the summer, but as conditions for the development of the fish are so good, the fingerling trout are large enough for planting and give good results wherever planted.

During the biennial period, not including the eggs and fish handled during the spring of 1928, there were hatched and distributed 3,253,600 trout from this station.

PRAIRIE CREEK

During the summer and fall of 1927, a survey was made to find a stream on the northwest coast from which cut-throat trout eggs could be obtained. After a close study and from data gathered in former years, we decided to establish a temporary hatchery and traps on Prairie Creek, Humboldt County. Prairie Creek is a tributary of Redwood Creek, one of the large streams of northern Humboldt County. Racks and traps were installed by an experienced crew, but the heavy rainfall in that section made the work difficult. The men, working in mud and water in the dense redwoods where there is very little if any sunshine during the winter months, and where even in the summer there is a heavy shade nearly all day from the giant redwood trees, caused the ground to be soft and muddy all winter. The tent hatchery was established under trying conditions, but by the middle of November the racks were in place and the crew was ready to collect cut-throat trout eggs as well as steelhead eggs in the spring. The station is located on Prairie Creek below its junction with Lost Man Creek. Eight eyeing troughs were installed at first and later the number increased to thirty. The water for the eyeing troughs was taken from Lost Man Creek and carried to the troughs through about 2500 feet of twelve-inch flume.

Two cabins were also built to accommodate the employees. The material was not on the ground soon enough to have the racks finished for the run of Chinook salmon and the high water allowed the cut-throat run to pass over the top of the racks. During the run of the silver salmon, 208,000 eggs were taken and the fry hatched at the station, excepting 60,000 which were taken to Fort Seward Hatchery to be liberated in Eel River.

During the steelhead run about 1,400,000 eggs were taken. 762,000 were shipped to Fort Seward Hatchery and the balance hatched, reared and are to be distributed from Prairie Creek Station.

Judging from the first season's showing, we think the establishing of the station was justifiable and the station is a decided asset. There is ample water for hatchery purposes, even if the capacity is increased and the water seems to be good.

Several log jams and other obstructions in Prairie Creek below the racks made it hard for the fish to ascend the creek. These have been partially removed and all of those which are in the way will be taken out before the salmon run this fall.

There are four varieties of fish that run in the creek—Chinook salmon, silver salmon, cut-throat trout, and steelhead trout. The Chinooks and steelhead are desirable for general distribution and the silver salmon and cut-throat trout are of value for distribution in Humboldt County.

BROOKDALE HATCHERY

After being in operation since 1905, we had the first epidemic of any consequence among the fish at this hatchery during the spring of 1927. An epidemic broke out among the fish in the hatchery that would not respond to any treatment that usually gives results. Dr. George A. Coleman made a pathological study and discovered a protozoan parasite affecting the fish that was deadly in its ravages. The source of this parasite was not discovered, but the condition of the fish was such that they were not resistant to any infectious disease as the water had been

polluted by parties living on the creek above. This pollution reduced the vitality of the fish so that they were subject to any pathogenic organism that might be in the water.

During 1927, and up to the present date, the water has been in excellent condition and the fish in the hatchery are thriving. The hatchery is centrally located and affords an excellent place to carry on pathological investigations, as well as any other investigations pertaining to new ideas on fish cultural problems.

BIG CREEK HATCHERY

This hatchery is located on the creek that bears its name, one-half mile above its junction at Scott Creek egg-collecting station, Santa Cruz County. During the season of 1927, a remarkably vigorous and healthy lot of fish were raised in this hatchery and were distributed throughout the adjacent counties. In the spring of 1928 an epidemic suddenly broke out among the fish. The symptoms were puzzling and ordinary treatments had no effect on them. Dr. Coleman made an examination and found an unidentified bacteria or bacillus at work in the blood and took specimens to the Hooper Foundation of the University of California, where Dr. Karl Meyer offered his able assistance, as well as the use of his technically trained staff and laboratory, in an attempt to solve the problem and discover a remedy. The disease proved to be a very malignant infection that in spite of our efforts, practically killed all the fish in the hatchery. The loss was approximately 700,000 strong vigorous fish. The symptoms of the disease and a study of the condition of the fish was similar to an epidemic that broke out in the Mt. Shasta Hatchery in 1908. After the disease ran its course at Mt. Shasta Hatchery and after the troughs had been disinfected, the disease did not show up again. We could not discover the origin of the disease at that time. We were of the opinion that the bacteria were brought to the hatchery water supply by birds, such as kingfishers, cranes or other birds that live around the water. At that time there were a number of farms not many miles from the hatchery through which different streams flowed and which were not in a sanitary condition. We could not determine the source of the infection.

The condition at Big Creek appeared to be the same thing. There is a possibility of the infection having been brought by birds to the hatchery supply from some pond in which there were diseased fish, or it may have been in the feed supplied the hatchery, which the foreman first suspected. The cause is remote. We hope that Dr. Meyer will be able to throw some light on this subject before he is through with his investigation.

COLD CREEK HATCHERY

As the Ukiah Hatchery was getting old and the foundation decayed, and the water supply insufficient for a hatchery large enough to supply the district including Marin, Sonoma, Mendocino and Lake counties, it was decided to establish a larger and more up-to-date hatchery for this district. Accordingly, a survey was made and Cold Creek selected as the proper site. It is only ten miles from Ukiah on the Ukiah-Tahoe highway. There is an abundance of good water in the creek that furnishes an abundant supply for the hatchery even in the driest years. Plans were made and construction begun during the fall of 1927. The hatchery was completed during March, 1928. The eggs and fry that had

been held in the Ukiah Hatchery were transferred to this new station during April. The station consists of a modern hatchery building containing 52 troughs, a residence for the superintendent, and rooms for the help in the hatchery building. Plans are being made to install a tank system and other improvements at this station during the fall.

SNOW MOUNTAIN EGG-COLLECTING STATION

This station furnished the usual number of steelhead eggs when all conditions are considered. During years of drought, the surplus water is held back in Lake Pillsbury, so that when these conditions occur the run of spawning fish is limited as they can not ascend to the egg-collecting station during periods of low water. The tanks, fishway, holding pens, etc., were repaired and improved in the fall and winter of 1926 and 1927.

Two million one hundred eighty thousand eggs were collected at Snow Mountain Station during the spring of 1927. Owing to the extremely high water during March, 1928, there was a sudden rise in Eel River that caused the flood water to pour over the Cape Horn dam where the Snow Mountain egg-collecting station is situated, to a depth of twelve feet. The pipe line had to be taken up and the fish in the hatchery tanks released. This flood no doubt caused the loss of a couple of million eggs, as the fish did not return after being driven down the river by the tremendous rush of roily water. Two million one hundred thousand eggs were taken before the flood conditions made it impossible for the crews to operate.

In the early part of April after the flood waters had subsided and the river was again in condition for the fish to run, the Snow Mountain Water and Power Company opened the gates on Gravelly Valley dam, known also as Lake Pillsbury, and after dropping the water level several feet below the crest of the dam, they closed the gates. By doing this they shut off the greater portion of the water descending the river so the fish that were ascending remained many miles below the traps; as a result the station was closed for the season.

MARLETTE LAKE, Nevada

In an effort to collect a large number of eastern brook trout eggs, we made arrangements with the Nevada State Commission on the same lines as we have done for the past 35 years, that the employees of the two Commissions, California and Nevada, were to cooperate in the egg collecting work and the eggs equally divided between the two states. The prospects were good at the opening of the season for a large take of eggs, but shortly after the crews arrived at the lake an unusually cold and early winter season set in, the water was cold and ice formed on the shores, which made seining very difficult. Marlette Lake is situated at an altitude of 8000 feet. Whenever conditions are favorable a take of 1,000,000 to 1,500,000 eggs can be depended on, but the early snow storms at the altitude of this lake made the work of collecting eggs very difficult and the take of eggs was a great deal less than we expected California's share of the eggs was 200,000. They were eyed and hatched out in good condition, producing strong, vigorous fish.

SMITH RIVER

During the winter of 1927 and spring of 1928 surveys were made for a site for an egg collecting station and hatchery in Del Norte County on a tributary of Smith River. It was found that Mill Creek was the most favorable stream on which to operate. Owing to the narrow canons of the other tributaries and the tremendous floods in the spring months, it is a very difficult and costly engineering problem to install traps in any of the tributaries or the main Smith River during the spring at the time when the steelhead trout are running, except in Mill Creek.

We were prepared to install racks, traps, holding pens or live cars on Mill Creek, tributary to Smith River, but could not get a permit or lease owing to complications arising over the transfer of the property on which we had selected the only suitable site.

Application was first made for a site to the John S. Owen Co., Eau Claire, Wisconsin, during the latter part of November, 1927. We received a letter from J. S. Oaker, secretary of the Del Norte Company, stating: "Your letter addressed to J. S. Owen Co. received. It is a matter that they are interested in only as stockholders, and the land has been sold, but not deeded. It is to be taken over as a memorial for F. D. Stout and his son. Mr. Stout died suddenly, but it was all agreed on at our last meeting. I am sending your letter to Mr. Lindsay, who is looking after Mr. Stout's matters, and you may hear from him."

Mr. J. R. Lindsay replied that no lease or permit would be granted, without giving us any especial reason. Since then we have written and received no reply. We have failed so far to get a lease, but will try again to obtain one.

Mill Creek affords the only place on any of the tributaries of Smith River that can be trapped for fish in the spring months. The main river below the South and Middle Forks carries such a large amount of water during the spring freshets that it would cost from $10,000 to $15,000 to install the racks and traps alone, not mentioning anything about the cost of the hatchery, cottages for the help, and equipment. The other branches are not favorable for spawning fish, as the narrow flume-like canyons have such a rapid flow of water that great difficulties would be encountered in trapping these streams, except probably in the upper reaches, and there are no roads to these points. Persons not familiar with this region who may be on Smith River during the fall do not realize the amount of water that descends this river when the winter and spring freshets are on.

During January, 1912, according to the U. S. Geological Survey Reports, the flow in the North Fork was 17,000 second-feet, South Fork 33,000 second-feet. The average maximum flow below the junction of these different streams would be approximately 30,000 second-feet. Even if concrete piers and steel bar traps were installed, the fish could not be handled in such a stream.

The matter has been taken up with the Redwood Empire Association and the Sportsmen's Association of Crescent City, asking these organizations to use their influence with J. R. Lindsay, administrator or manager of the Stout estate, to assist us in getting a permit or lease for a site on Mill Creek.

KLAMATHON SALMON EGG-COLLECTING STATION

During the seasons of 1926 and 1927 there were 28,000,000 Chinook salmon eggs collected at this station.

In October, 1927, the run of salmon that usually reaches the racks in large numbers began to decline and the run of fish did not ascend the river in their usual numbers. This was caused by the low stage of the water and the great amount of algal growths in the water of the Klamath River. This condition occurs whenever the river is low. The gases thrown off by the algae and the swampy odor of the water have a bad effect on the salmon on the upper reaches during seasons or conditions of low water. Consequently, the salmon do not ascend the river as they do when the water is cooler and is less affected by the gases thrown off by the algae in the river.

Whenever we have the usual amount of rainfall on the upper reaches of the river during the salmon run, or if the river is up to normal flow from the previous winter storms, the salmon will ascend in numbers as usual to the Klamathon Station.

TAHOE HATCHERY

During the biennial period this station has been operated to practically its full capacity.

A pond and aerating system were installed in the fall of 1926 to cause the temperature of the water from the springs to rise to a higher degree, as well as to give it a better aeration. Since the installation of the pond and aerating system, a marked improvement can be noticed in the fish, as they grow more rapidly and are more active in their habits. The Tahoe Hatchery was operated during the winter of 1927 and 1928, the first time since fish cultural operations were carried on at Lake Tahoe. Comfortable buildings for the crew were built, and the fall spawning species were hatched.

From now on eastern brook, Loch Leven and any fall or winter eggs can be shipped to Tahoe Hatchery and be cared for until the following summer before planting.

The severe and unusual rain storms that prevailed in the Tahoe region during the latter part of March, 1928, damaged and wrecked all the traps at the auxiliary stations where the eggs are collected. The trap in Blackwood Creek was carried away. At Taylor Creek the highest water on record caused a log jam to form above the trap 100 feet long and ten feet high. The state highway bridge just below the trap was carried away, and it took a crew of men several days to remove the debris from the trap and bridge.

At the Upper Truckee River traps, the flood washed a large hole under the racks and the fish escaped. At the height of the flood the water at the Upper Truckee River traps was 1000 feet wide. This storm piled up very little snow. It was a phenomenal rain storm that did a great deal of damage and soon subsided, leaving very little water in the ground to feed the springs. We were compelled to ship eggs from other stations to fill the Tahoe and Tallac hatcheries, as well as to have fish for the Blackwood Creek tanks.

BLACKWOOD CREEK TANKS

In an effort to satisfy the demands of the residents and others visiting the Tahoe region, we agreed to install a tank system in which to hold the fish until larger before planting them in the fall. Plans were made, and after procuring a lease on Blackwood Creek for a site, twelve tanks were placed in a good building, and late in the season of 1926, 400,000 black-spotted trout were placed in the tanks from Tahoe Hatchery. They thrived until the slush ice compelled the crew to liberate them.

During 1927 the tanks were used again successfully, but the fish were planted earlier in the season, as it is not a good plan to distribute fish artificially reared and fed, in the early winter, when the natural feed is very scarce and hard for the fish to get. These tanks will be used again this season to handle the surplus fish in good condition, and with the closing of the tributary streams to Lake Tahoe, it will in a few years help in restoring the fishing in the lake. Eggs were shipped from Rush Creek Station to help fill the Tahoe Station, as well as to give us a supply for the tanks.

TALLAC HATCHERY

This hatchery has been operated as in the past. The water supply is good until early in July, when the algae and other conditions make it necessary to distribute the fish. The fish always make a rapid and healthy growth until early in July, when they become affected if not planted. The hatchery is very useful in early spring to eye eggs of the black spotted and large lake varieties of trout, as well as to hatch steelhead and rainbow eggs. A large number of steelhead and rainbow trout eggs should be hatched in Tallac Hatchery, and the resulting fry placed in the lake so as to provide top or fly fishing for the anglers that frequent the lake. The black spotted, large lake and Mackinaw trout are all too hard to catch for the ordinary angler. They feed in deep water and only experienced fishermen such as the old market fishermen that depleted the fish in the lake, can make any success in fishing, except in a few favorite places. We have had this plan in mind for the last twelve years, but as the take of eggs was not sufficient to ship enough to the lake to make any showing, there has been a continual complaint by certain persons that there was but very few fish in the lake.

If we can not get the eggs in California, which we feel can not be done, that is, in numbers great enough to stock this large body of water, I would recommend that arrangements be made to procure at least four or five million steelhead eggs annually for Lake Tahoe for at least four years. It will take this length of time to stock a body of water as large as Lake Tahoe with a new species of fish. We have planted a few hundred thousand steelhead in the lake, but not enough to insure good fishing. A number of fine specimens are caught each season, but to stock this large body of water with steelhead or any other top feeding species, at least four or five million trout should be introduced for several succeeding years. Then results will be had in three or four years.

FIG. 22. Kernville resting ponds, 1927. Trout in this pond grew rapidly and averaged four inches in length when planted.

SPINEY-RAYED AND CAT FISHES

During the biennial period ending June 30, 1928, several shipments of the spiney-rayed fishes and catfishes were made to different places. The more important shipments were during October, 1926, when 3000 bluegill sunfish and 500 crappies were planted in Lake Elsinore, Riverside County, and 4000 forked tail or channel catfish were distributed in Clear Lake, Lake County. A shipment of bluegill sunfish and crappies were planted in Big Bear Lake, San Bernardino County, and in several other important lakes.

Many thousands of these fish should be planted each season in the lakes and sloughs in the lower altitudes where trout will not thrive, and efforts should be made to educate the people to catch these species, as they are good game and food fishes.

Following is a list of the more important shipments made of these species:

1926

	Bluegill Sunfish	*Catfish*	*Crappie*
Riverside County (Lake Elsinore)	3000	---	500
San Bernardino County (Warm Creek)	384	---	100
San Diego County (Lower Otay, Sweetwater and Hodges Lake)	---	---	147
Tuolumne County (Don Pedro Reservoir)	450	---	125
Calaveras County	300	300	---
Lake County (Clear Lake)	---	4000	---
1927			
San Bernardino County (Big Bear Lake)	1350	650	---
Stanislaus County	125	50	---
Totals	5609	5000	672

Total all species, 11,281

SUMMARY OF RECOMMENDATIONS FOR THE ENSUING BIENNIAL PERIOD OR WHEN FUNDS ARE AVAILABLE

The establishing of a large hatchery in the vicinity of Lake Almanor.

A hatchery on the North Fork of Yuba River.

A permanent hatchery on the San Gabriel River, or a larger hatchery on Forsee Creek, San Bernardino County, or on the San Gabriel, if there is sufficient water to furnish a hatchery large enough to supply all of southern California. If not, establish two hatcheries, one on the San Gabriel River and one on the Santa Ana River or tributary.

Construct a permanent hatchery on Prairie Creek, Humboldt County.

A permanent hatchery on Mormon Creek, Tuolumne County, if the hatchery supply from the tunnel can be secured.

Abandon the Kern River Experimental Station and establish a permanent hatchery on Big Pine Creek, Inyo County after experiments have determined whether the water is suitable for all conditions of fish cultural purposes.

Carry on experiments in Alpine County to find the most suitable site in that region.

Construct holding tanks at Cold Creek Hatchery to hold the surplus fish.

Construct a battery of tanks at Big Creek Hatchery.

Install four more tanks at Yosemite Hatchery and build a suitable shed over the tanks.

Build a permanent hatchery on the Kings River or one of its tributaries.

Remodel and improve Brookdale Hatchery.

Begin a survey of sites for the building of pond systems to raise brood stock to furnish eggs for all the hatcheries, and get leases with options to purchase the same as soon as funds are available.

I recommend that ponds to furnish at least 40,000,000 eggs per annum be planned and established when money is available for the purpose.

That surveys be made of the barren lakes and streams in the High Sierra; to have proper aquatic plants and insects introduced to furnish the greatest amount of food possible for the fish when these barren waters are stocked with trout; organizing a crew under an experienced man to collect the fish from the overflow basins that dry up each summer, as well as to rescue trout from the streams affected by drought; establishing ponds for the raising of all species of spiney-rayed and catfishes for distribution in the sections where these fish are taken in the largest numbers; introduce two or more species of game and food fishes into California waters after a thorough survey has been made by a trained biologist or fish culturist. In this way the proper species may be introduced and placed where they will be of the most benefit to the public.

Recommend to the legislature a shorter season on trout in the Sierra range and coastal districts.

In the Sierra Nevada range a later spring opening, and an earlier fall closing is necessary.

In the coastal region an earlier spring season could be had if an earlier closing season was enforced.

The establishing of a laboratory in conjunction with one of the hatcheries, where experiments can be carried out to find a suitable substitute for the fish food now used. This laboratory should be operated by a specially trained fish culturist.

More attention should be paid to the closing of lakes and streams to increase the number of spawners to assist in getting a larger supply of eggs. Without the seed being sown there will be no harvest ,and if the Commission does not distribute more fish there will be no increase in the number of fish to be caught.

Pack trains should be purchased to carry the fingerling trout to the barren lakes in the inaccessible regions for automobiles.

Encouraging the raising of the warm water species of game and food fishes in the valley regions or low land of the state by furnishing a few to each individual who builds a pond in compliance with the Domestic Fish Law.

Discourage as far as possible persons from leasing or purchasing lands along natural streams and closing them to the public for fishing purposes.

Amend the Domestic Fish Law so that fish cannot be purchased from private hatcheries and placed in streams closed to the public.

Amend section 4085½ so that the state, through the Division of Fish and Game, from funds set aside for the purpose from angling licenses, can pay one-half of the price for right-of-ways along streams flowing

through uncultivated lands. This will encourage the counties to condemn right-of-ways for fishing purposes, and will discourage persons desiring to close the streams to the public who may lease or own lands in the wild state, not cultivated.

We again reiterate our recommendation against the use of fish eggs of any species for bait. A great many persons oppose this on the grounds that many women and children would be deprived of the pleasure of catching fish if not allowed to use salmon eggs and the eggs of other fishes. We do not agree with these persons. It is true that they can not take them so easily, but it is not only the women and children who use them. Hundreds of so-called sportsmen use salmon eggs for bait to take the fish, and use them to chum the fish or place them in ponds in the streams, as well as in the lakes where the fish will congregate in large numbers and are so easily taken that the use of any kind of fish eggs is detrimental to conservation.

The use of spoons, spinners, artificial flies, plugs, and natural insects and worms furnishes all that is necessary for persons to get a mess of fish without using the most deadly and alluring bait that can be found and that is the eggs of fishes, particularly canned or fresh salmon eggs.

RECOMMENDATIONS REGARDING CLOSING LAKES AND BUILDING POND SYSTEMS

Our foremen and field men have examined and studied every available source of egg supply in the state and there is no place of any consequence that can be developed. We have a trap in Manzanita Lake, also one being placed in Butte Lake.

We had Mr. Firmin B. Hamor, an expert on egg-collecting stations in the Rocky Mountains, make a survey of Lake Eleanor and several other lakes in that region, and he reported, the same as our men, that the lakes have been so heavily fished that they will no longer furnish enough adult or spawning fish to justify the work of attempting to install new egg-collecting stations until some of the lakes are built up by closing them to fishing for a period of years.

In selecting lakes for this, every detail as to the possibilities of increasing the fish in a reasonable time must be taken into consideration. Many lakes, even before there was any fishing, had only a limited number of fish in them. The only lakes that should be closed are lakes that have physical conditions that will give the trout a chance to increase and get to a size that will produce an average number of healthy eggs.

As an illustration, I quote from Mr. Hamor's report on Lake Eleanor:

> "Have just returned from Lake Eleanor and do not have a good report to make. We caught over 200 females to get 50,000 spawn and it took us 10 days to catch that number of fish. Seventy-five per cent of the fish there are too old to spawn well any more, and there are no young fish coming on. However, I saw twenty or thirty little fish, rainbow, 2½ inches long, which must be yearlings, which show but little growth. There are fish there 18 inches long, weight 1½ pounds, with heads as big as a saucer.
>
> "Some were spawning on the dam, which we could not catch, and everyone was talking of the millions of fish which, when counted out, were less than one hundred. When the stream bed was cleaned

these were caught with hook and line, May 1. I do not think it will ever be a spawning stream, as there is no feed, and not many fish. I procured 50,000 eggs and held them nine days at the lake before coming here and the loss was 100 eggs out of 50,000."

This lake was supposed to have a large number of rainbow trout in it. Our survey made in the summer of 1927 did not indicate that there were enough fish in the lake to justify the expense of installing an egg-collecting station. During April we arranged to have Mr. Hamor make a second survey at the time the fish were running.

While these lakes may furnish a considerable number of eggs, they will naturally be subject to seasonal conditions, and will not always furnish the required number of eggs for the hatcheries. The only safe and sure way of getting eggs for our hatcheries is to construct pond systems the same as at Mt. Shasta Hatchery, where an adequate supply of eggs can be collected to furnish all the hatcheries. Plans should be made at an early date to procure sites for these pond systems. They should be located in the proper locations, and the altitude, temperature, water supply and proximity to railroads must be considered.

BIOLOGICAL WORK

The work of George A. Coleman has been of great service to the Department of Fish Culture. Mr. Coleman made trips of inspection of holding ponds, investigated lakes and streams, and assisted in the pathological work at the hatcheries. He has made scientific surveys of lakes and streams that will have to be finished up later. The biological problems are too many for one man. Coleman should have one or two able, trained assistants, to carry on the surveys that are necessary if the best results are to be obtained. The biological work handled by Coleman during the last two years will be of lasting benefit, as he has laid the foundation for a series of investigations, as well as finishing up some important work for the bureau that we have not space to give in detail. If desired, we will furnish a supplemental report on the biological work for the quarterly, or in a separate bulletin.

N.B.—The statistical report for the seasons 1926-27 of the fish distributed from the different hatcheries will be found in the appendix.

REPORT OF THE BUREAU OF HYDRAULICS

By JOHN SPENCER, In Charge

The Bureau of Hydraulics was formed by the Commission in June, 1926, and for the first seven months it was concerned with fishway and fish screen installations. In the early part of 1927 pollution control, or prevention of pollution, of public waters was added. Every installation of a fishway, screen or investigation of pollution is an individual problem. If good results are to be obtained each case must be handled as such. In fishway and screen installations, a field survey is made and the owner consulted when possible. Plans and orders are then issued covering the proposed work and, finally, an inspection is made to see that the completed work is according to the plans.

Proposed installations of fishways and fish screens are considered not only with the view of complying with the law, but also to see that future operation is considered together with the best interests of the owners or divertors of water. This procedure has been productive of good results. Legal action is resorted to only when other means of having the desired equipment installed have failed.

It was early thought that the most important work was to see that the installations in place were functioning properly. Reports were received from the deputies, and owners of installations not in order were requested to make the proper repairs. This phase of the work requires a constant follow-up.

In this connection it is desired to express appreciation for the work done by the patrol forces. The Bureau could not, with any degree of efficiency, function without their support and cooperation. The deputies are familiar with their respective territories and it is on them that the Bureau depends primarily for data on needed installations of screens and fishways and their effective operation.

FISH SCREENS

The State of California, as has many times been said, is dependent for its growth and prosperity upon the utilization of its water. It is fortunate, therefore, that properly designed and installed fish screens offer no appreciable hindrance to the flow or use of water. When a screen does interfere with the flow of water it is generally found that the owner has not followed the plans in construction, made a poor installation, or neglected to give it any attention whatsoever.

Criticism is often made of the types of fish screens in use by the Commission. In an effort to see if improvements could be made that would be of advantage to the divertors of water and at the same time be an effective fish stop, a conference of the irrigationists and power companies was held in April, 1926. Two committees were appointed, one representing the power companies and one the irrigationists, to study the fish screen problem with the view of assisting the Commission. The director is informed that the power committee did some work, but to date no report, recommendations or suggestions have been received from either of the committees. It is felt that the types of screens now used are, all factors considered, well suited to California conditions. This does not, however, preclude further study on the matter and it is

to be regretted that the interests using the water and making screens necessary should not be more actively disposed to assist in bettering a problem they themselves create.

FISHWAYS

The law states that fish ladders shall be constructed when, in the judgment of the Commission, one is required or, in lieu thereof, a hatchery may be constructed or fry planted. The practical working out of these provisions is that many of the owners of the high dams escape their obligations to the State and do nothing for fish life or its perpetuation, except as the reservoir formed may be of aid.

This is brought about due to the fact that fish ladders, as far as present information goes, may be installed on dams only up to about sixty feet in height. Hence dams beyond these heights are not provided with fish ladders and hatchery construction must be resorted to or fry planted as covered by the law. There is a limit to hatchery construction, because after the owner of the dam constructs the hatchery it is turned over to the state and the Commission must pay for its operation and maintenance.

The burden of operation and maintenance of numerous hatcheries by the Commission is too great, and the other alternative of planting purchased fry has not yet been practical. The state's progress is dependent on its efficient use of its waters, but with the proper foresight this use of the water need not necessarily tend to decrease the commercial and game fish life in the state. The problem presented has many phases and should be given careful consideration in order that a plan of action may be mapped out and appropriate remedial legislation passed.

Comments and criticisms are heard that fish ladders are failures, that no fish have been seen going over, that no water was running through the ladder, that fish were seen at base of dam and none in the ladder, and like statements. When any comment or complaint comes to the bureau's attention the matter is investigated to see if remedial action is required. The interest of the public in this matter is welcomed as it aids the bureau in its check-up.

Fishways are for the purpose of aiding migrating fish on their journey to spawning areas to pass obstructions, such as dams, in the streams. Fishways or ladders generally consist of pools, one pool slightly higher than the preceding one, rising from near the downstream base of the dam to the crest, the water flowing through the pools in an even amount. Unless water is to be passed by a dam to maintain fish life below, it is not always necessary to have a fish ladder in continual operation. It is essential, however, that a ladder shall be in operation at the times of fish migrations. Some streams are dry in the summer months, yet in the fall, winter and spring these streams do much to promote fish life as fish have ascended, spawned, hatched and the fry returned before the stream becomes dry. The dams on such streams require fish ladders as well as on the streams that flow continually.

The periodic inspection of fishways by deputies results in as near to proper functioning of the fishways as conditions will permit.

Surveys made prior to the formation of this bureau are being checked and, when found that the plans still apply, steps are instituted to have

the fishways installed. If changes have occurred which necessitate a new survey, this is made and work of installation resumed.

There are many dams on the streams of this state that have not yet been surveyed. The most important ones, of course, have received first attention.

In several instances where the orders of the Commission requiring fishway installation have not been followed out the aid of the courts has been sought. The legal department will no doubt report on these.

The bureau is happy to state that, of the fishways installed during the past two years, reports show these installations to be efficient. A fishway installation of considerable importance was made by the Anderson-Cottonwood Irrigation District on the Sacramento River at Redding. This dam had formed a barrier to migrating salmon and steelhead for seven years and only a small number of fish had succeeded in passing. A change in the plan came as the result of a harmonious conference and construction of the fishway followed. Now the migrating salmon and steelhead pass on upstream. An effective barrier to migrating fish can stop the run up that stream and in a few years make the stream above practically barren of migrating fish life. The installation of three fishways on dams on coast streams in Mendocino County opened up a large area which had been closed for many years to spawning fish.

In the latter part of 1926 much publicity was given the alleged satisfactory working of a fishway over a dam 200 feet in height (planned ultimate height 250 feet) on the Baker River at Concrete, Washington. If the facts warranted the statements made, then a great advance had been made in fishway construction. In addition the proponents of hydro-electric development on the Klamath River might be encouraged to attack the initiative measure passed by the people of California in 1924 which saved that river as a fish reserve.

Mr. N. B. Scofield of the Bureau of Commercial Fisheries and the writer inspected and studied the results of the operation of this fish ladder and presented their views to the convention of the International Pacific Salmon Investigation Federation, which met in Seattle, December, 1926. This body passed a resolution condemning the publicity as presented to the public as not being warranted by the facts. It can not be said, at this date, that the Baker River Dam fishway is a success.

POLLUTION CONTROL OF THE PUBLIC WATERS

The pollution work was added to the bureau in January, 1927, and subsequent to that time each reported case of pollution has been checked and remedial measures effected where conditions warranted. Bureau action has not, however, been dependent on the reports received, in fact, the greater portion of the activities have been initiated by the bureau. It was found by a brief preliminary inspection that many cases of pollution were occurring and the director was of the opinion that greater good would be accomplished by working on each pollution problem as presented rather than any general survey of conditions. The results attained will bear out that viewpoint.

As in the other phases of bureau activities legal action is only resorted to after other means fail to accomplish results. Where an industry or individuals are polluting public waters, an effort is made to have it remedied and reasonable time is given to effect the needed changes.

In wilful cases of pollution a complaint is filed immediately. In general, it may be said that this branch of the work is carried on from an educational and cooperative viewpoint.

It was soon determined that the most serious problem was that of oil pollution. California is one of the three states in the nation that lead in oil production and as most of the fields and refineries are contiguous to public waters the resulting oil pollution is of large proportions.

The oil refineries use considerable water in their operations and this water carries surface or "free oil," and oil mixed in with particles of matter which does not readily come to the surface. The problem presented is to make the oil come to the surface where it may be skimmed off. On inspection it was found that many of the refineries permitted oil to escape with the waste water. Due to betterments in the reclaiming systems, the refineries inspected are now passing a waste water that is free from visible signs of oil. This prevention of pollution by

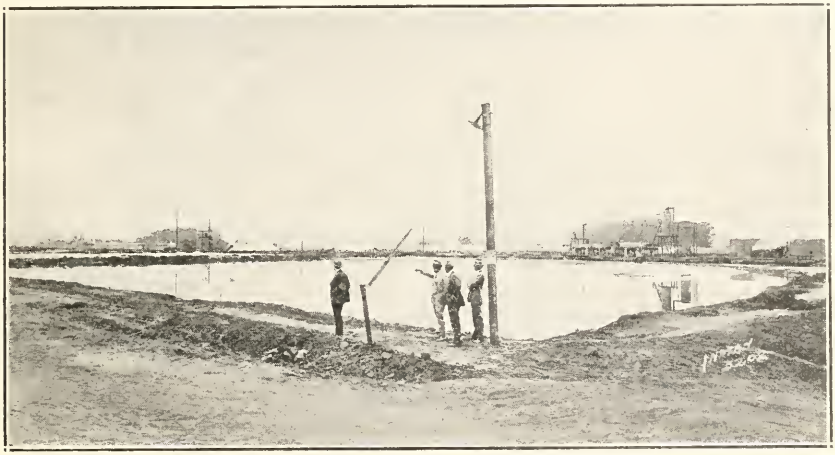


FIG. 23. Oil Operators, Inc., original sumps with treatment equipment to handle waste and prevent pollution. Overloading of these sumps due to deeper drilling at Signal Hill necessitated additional sumps. Photo, courtesy of A. R. Yorston, vice president, Oil Operators, Inc.

refineries has very materially helped in improving the adjacent public waters. Individual expenditures by refineries to attain this condition have ranged from several thousand dollars to over one hundred thousand dollars.

Many of the oil producing fields are in natural drainages to public waters. This presents a difficult problem in pollution prevention. In the hurry of drilling and producing, little thought is had for escaping oil. Congestion of wells in a small area and many independent operators add to the problem. This is well illustrated by the southern California fields, notably Signal Hill and Huntington Beach.

An example worthy of notice of cooperative effort to prevent oil pollution occurred at the Signal Hill field. Oil escaping from this field found its way to the ocean waters and, lodging on the beach in the vicinity of Long Beach, hindered the full enjoyment of the beach. The majority of the Signal Hill operators organized the Oil Operators, Inc., for the purpose of controlling the escaping oil. Originally 13 acres

were purchased and partitioned off into sumps, a main pipe line connected the sumps with the field and operators delivered their wastes into this pipe line. The system worked satisfactorily. Deeper oil sands were found in Signal Hill, however, and practically without warning the sumps of Oil Operators, Inc., were filled with sand. This situation was met in a most energetic manner by the officers and members and in less than a month a 225,000-barrel sump was in operation. At present the investment by the Oil Operators, Inc., is about $225,000 and the system is more than self supporting. A few operators were so little concerned about oil pollution, however, that no effort was made by them to clean up their properties, even after warnings and legal action were resorted to. At the present time the Signal Hill field is in a good condition, but inasmuch as the ground is saturated with past escaping oil, it will be several years before all pollution ceases.

In the work carried on in the Signal Hill field and vicinity, the city of Long Beach has assisted the bureau whenever assistance was desired. This has been of material aid and is much appreciated.

At Huntington Beach the drilling is very congested, derricks in some places touching one another. Oil escaped to the city streets and drains and finally flowed to the ocean. The city was unable to cope with the problem. A complete survey was made and evidence gathered, followed by the filing of an injunction suit naming companies and operators. Prior to the hearing of this case, certain companies cleaned up and the suits as against these concerns were dismissed. Of the remainder, the Court found for the Commission. The necessary legal steps are being followed out to complete these cases and effect a satisfactory "cleanup." In general, the improvement in the condition of the field is very noticeable.

A large portion of the oil industry is in southern California and the foregoing citations are given to show the range and form that "cleanup" work takes. Even a partial listing of the work done would be too lengthy for this report. As a result of the publicity that the work has received some improvements have been made not directly initiated by the bureau. Improvements contemplated or now under way will cost approximately $1,000,000. The Public Relations Bureau of the Commission has been of great help in pollution and other branches of the work by giving the public the division's viewpoint.

The Ventura oil field, a portion of which is in the Ventura River channel, has been improved so that very little pollution is occurring. Early in 1928 the river water and channel was so free from oil that trout fry were seen in the vicinity of the derricks, a sight not previously witnessed for several years.

The Summerland oil field was inspected and it was found that oil and its products were escaping into the beach sands and ocean. Conferences with the owners failing of results, appropriate legal action was instituted. It is hoped that an early determination of the cases will be productive of the desired results.

The Rincon oil field being developed on tidelands north of Ventura furnishes a demonstration of what may be done to obviate and prevent pollution even under adverse conditions. The Bureau conferred with the operators with respect to oil pollution and the response has been so satisfactory that to date no pollution has been reported from these operations.

It is a pleasure to report that the oil industry itself realizes this pollution problem. The American Petroleum Institute, a national organization and representative of the oil industry, appointed a committee to investigate oil pollution in the United States. The report is very instructive but lack of space prevents further comment than to say that the standards arrived at in California are higher than those recommended in the above report. This, of course, is of great benefit to conservation.

The Bureau would like to set out in detail the great amount of work done by the oil industry in the program of pollution prevention but such procedure would be too tedious for a report of this kind. The larger units of the oil industry have met the issue and have taken energetic measures to meet the standards, as fixed. This may better be appreciated when it is realized that, conservatively, $2,000,000 has been spent in the last eighteen months in improvements to prevent oil pollution. With very few exceptions, and these generally small and independent operators, this has all been accomplished through conferences. The general whole-hearted manner in which the oil industry has met this problem is very commendable.

A number of the deputies have reported sawmill pollution occurring in the northern part of the state. The Bureau has assisted, where desired, and improvements have been effected. In this connection it is well to remember that effects of sawmill pollution may stay with us for many years. This is borne out by the present condition of the Truckee River which is at the present time carrying sawdust. This sawdust was placed in the river prior to 1895 by the sawmills in that region and filled the channel to over 10 feet in depth in places. Injunction proceedings in that year stopped the practice. The high waters of the season of 1928 scoured the channel and exposed the sawdust and edging piles. Present water action continually moves some of this accumulation with consequent damage to fish and plant life of the river.

Pollution work of the Bureau has brought it in contact with practically all lines of industry. Remedial measures have generally been effected after conferences where pollution occurred. Lengthy studies have not been necessary as the matters under consideration were recognized by all as pollution. As the work develops more scientific study may be required.

Some time has been spent on activities other than the ones covered, which represent major items. It is recommended that the Bureau's budget be increased in order that the matters before the Bureau may be more expeditiously disposed of and greater strides made in the conservation of the fish life, natural and planted, in streams.

REPORT OF THE BUREAU OF RESEARCH

By R. E. Ludlum, In Charge

In 1926 a Bureau of Statistics and Game Problems was created in the Patrol Department to prepare statistical information and to investigate game problems and diseases. Additional functions were assigned to this bureau and the scope of activity was enlarged to the extent that, in October, 1927, it was detached from the Patrol Department and a Bureau of Research was established which now functions directly under the executive officer. A report concerning the more important activities follows:

Deer Tag Data.—The deer tag license law which was enacted in 1927 provides that every person must procure deer tags, in duplicate, before hunting deer. The original tag is to be attached to the deer when killed and the duplicate mailed to the Division of Fish and Game. One of the purposes of the new law is to secure accurate information regarding the number of deer killed and the localities in which they were taken. Comparison of tabulations of deer killed during successive open seasons will furnish much information regarding the increase or decrease of these animals. Such data will be of value for guidance in the enactment of legislation for the protection of deer. With a comparative record of the annual toll taken by hunters and with a reliable estimate of the abundance of deer, it is possible to prescribe such open seasons and bag limits that the necessary reserve for breeding stock will be maintained.

A complete tabulation of data obtained from duplicate deer tags sent in by hunters during the 1927 season has been compiled and published in *California Fish and Game* for January, 1928, and for April, 1928. A summary of deer killed in the several counties will be found on page 150 of the appendix.

Case and Seizure Data.—Records of seizures and cases, together with fines and forfeitures imposed and collected, are entered in books kept for this purpose. Quarterly reports have been compiled and published in *California Fish and Game*. Biennial report will be found on pages 136-139 of the appendix.

Fur Trapping Data.—A compilation of fur trapping data has been made up from reports furnished by licensed trappers. These data are published on page 152 of the appendix and show the value of the fur crop to the commercial trapper. While the average return to each trapper is not large, yet the aggregate is a considerable sum. The protection of fur-bearing mammals is a phase of conservation that usually receives but little attention. The annual toll taken by rodents of cultivated crops and natural vegetation is a large loss and reduced the amount of food available for domestic stock as well as game. The carnivorous animals, including the fur-bearers, are nature's check on rodents, and perform a useful service in many cases especially in those sections where organized rodent control campaigns are not conducted. The control of predatory species, however, is a serious problem in which the commercial trapper plays an important part. By reference to the above mentioned report it will be noted that, in addition to protected fur-bearers, the commercial trappers are credited with the

following: 1926-27, coyotes, 9631; wild cats, 7015; 1927-28, coyotes, 13,941; wild cats, 12,250. The returns from skins of coyotes and wild cats average about 25 per cent of the annual fur sales, which of itself would not be sufficient to keep the present number of trappers in the field. The value of the commercial trapper in the control of coyotes and wild cats cannot be discounted and this service is performed without cost to the taxpayer. Reasonable protection of skunk, raccoon, ring-tailed cat, pine marten, fisher, river otter, wolverine, mink, fox, beaver, muskrat and bear will tend to keep a large number of trappers in the field, which will materially assist in predatory animal control.

Predatory Animal Control.—*Mountain lions*—In 1926 bounties were paid on 249 mountain lions, and in 1927 bounties were paid on 241 mountain lions. Bounty was first placed on mountain lions in 1907. From that time to December 31, 1927, a total of 5170 claims have been paid—an average of 246 claims per year. It will be noted that the kill of lions for the years 1926 and 1927 is very close to the annual average for the twenty-one-year period, which indicates that the bounty system alone is not sufficient to effectively reduce the lion population in the state. The annual toll of deer taken by lions is serious. Assume that the present lion population is approximately 500, and that each lion kills an average of one deer per week—500 $\times$ 52 is 26,000 deer per year. When it is noted that the hunters reported the kill of 19,507 deer in 1927, it will be seen that the toll taken by lions may be estimated at 33 per cent greater than the kill by hunters. The necessity for further reducing the lion population is very evident. Statement of bounties paid on mountain lions will be found on page 151 of the appendix.

During the past two years Jay Bruce, state lion hunter, has killed about 15 per cent of all the lions taken in the state, which demonstrates the value of this form of lion control. It is recommended that three additional lion hunters be employed on full-time basis.

Coyotes, wild cats and other predatory species.—In April, 1928, two trappers were employed and assigned to predatory animal control and since that time have worked in four game refuges: 3-E, Santa Clara County; 3-F, Contra Costa County; 2-A, Glenn and Lake counties, and 1-O, El Dorado County. These predatory animal control operations are being conducted in cooperation with the State Department of Agriculture and the U. S. Bureau of Biological Survey. It is now planned to continue this work, especially in the game refuges, and it is recommended that two additional trappers be employed for this purpose.

Game Breeding.—For the year 1926, 164 game breeder's licenses were issued and in 1927 the number increased to 201. Ring-necked pheasants, valley quail and mallard ducks have been raised in considerable numbers; the demand for these has apparently been equal to the supply. Most of the domestically reared game birds have been sold for stocking purposes or to other game breeders for breeding stock. The number of inquiries received from prospective purchasers of domestically reared game has been so large that lists of breeders who are offering stock for sale have been prepared for distribution. A report showing the operations of game breeders will be found on page 140 of the appendix.

Fur Farming.—An increased interest in fur farming has been displayed during the past two years. The raising of silver, black and cross foxes has probably shown the most development. Muskrats would thrive in many localities but the possibilities of this branch of fur farming are limited due to the necessity of prohibiting the raising of these animals in localities where they could cause damage to irrigation canals, ditches and levees or other protective works. Raccoon, skunk, mink and other fur bearers are raised to some extent in captivity, and trappers are finding that many of these animals, when trapped, are more valuable if kept alive and sold for breeding purposes than if the pelts alone are sold.

Pathological Investigations.—Another function assigned to this bureau is the survey of diseases that affect wild birds and mammals. This study of game diseases has been made possible largely through the cooperation of the University of California. Dr. K. F. Meyer,

FIG. 24. View of duck hospital established at Buena Vista Lake, fall of 1927. The pintail ducks in the picture were rescued as sick birds and after treatment were banded and liberated. Photograph by Roy Ludlum.

Director of Hooper Foundation for Medical Research, has accepted at that institution. Parasitological studies are conducted in the laboraan appointment as Consulting Pathologist of the Division of Fish and Game and has undertaken the supervision of our pathological investigations. With facilities furnished at Hooper Foundation, this division has equipped a pathological laboratory and a chemical laboratory tories of the Zoological Department of the University of California under the direction of Professor C. A. Kofoid.

R. J. Irvine, chemist, has been attached to the bureau since its creation. E. C. O'Roke, parasitologist, was employed on a part time basis in November, 1927. Dr. H. Van Roekel, pathologist, reported for duty on June 1, 1928. Due to the inability to secure the services of the latter two scientists until so late in the biennial period, much of the program that had been outlined has not been completed.

"Duck disease," which has caused very serious losses of ducks in the past, is one of the principal problems. This disease has occurred in several of the western states and at different times has appeared in at least five widely separated sections of California. The disease has been diagnosed generally as "alkali poisoning."

During the late summer of 1926 and again in the fall of 1927, ducks were affected with a malady at Tule Lake, Modoc County, and Buena Vista Lake, Kern County, respectively. The investigations made in these instances indicate that alkali poisoning was not the cause of the disease, but that in all probability the mortalities may have been produced by a biochemical action that was attendant to the decomposition of large amounts of organic matter in lake water. Laboratory studies have not progressed to the extent that it is possible to make positive diagnosis, but this work is now well under way and will be carried on as rapidly as possible.

The determination of the cause of "duck disease" is a very important conservation problem. Knowledge of the cause of this disease will probably suggest measures that can be taken to reduce the mortality in future occurrences. It has been found that many of the afflicted ducks would recover rapidly when placed on different water and food. Some 800 of the sick birds were taken from Buena Vista Lake to a nearby "duck hospital" that was established for the purpose. A large percentage recovered to the extent that they were liberated after the close of the hunting season. All of these ducks were banded before being liberated. Since California is now committed to a program for the acquisition of game refuges, it is essential that the cause or causes of duck sickness be determined so that this information can be available when waterfowl refuges are selected.

Studies have been started to determine the identification, life cycles, and pathogenicity of the external and internal parasites of deer, quail, pheasants, duck, geese and other species. Considerable progress has been made in the work on ducks, geese and quail. A report on a blood parasite (Haemoproteus, or bird malaria) of quail has been recently published in *California Fish and Game*. Another problem that has been given attention is the relationship of the parasites of nongame birds to those of game birds. Studies of this kind help to solve the problem of carriers and the ways in which parasites are distributed.

A survey of the diseases of all game species is a large undertaking. Scientists have not directed their attention to the pathology of game to any great extent; but little of this work has been done in this state. In most cases it has been found that the normal condition of California game is not known; this must first be ascertained as the "abnormal" can not be determined until after the "normal" is established.

A general program has been outlined but of necessity the work must proceed slowly as the opportunity to secure specimens is usually seasonal and much of the material must be collected during the open seasons. It is planned to extend these investigations to include the study of the diseases of all of the more important species, both in the field and at the state game farm. These studies will disclose the effect of disease on the abundance of game, suggest any measures that may be taken to reduce the mortality, and furnish much information of scientific value to conservation.

Acknowledgments.—This division is fortunate to be able to conduct a survey of game diseases under such favorable circumstances. It is desired to express to President Campbell of the University of California, the Board of Regents, Dr. K. F. Meyer, Professor C. A. Kofoid, Dr. Joseph Grinnell and other members of the faculty our appreciation of their valuable cooperation. We also desire to express our thanks to the State Department of Agriculture, the U. S. Bureau of Biological Survey, the California Academy of Sciences, the Associated Sportsmen's Clubs, and all of those agencies and individuals that have assisted in the progress of the work of this bureau.

REPORT OF THE BUREAU OF PUBLIC RELATIONS

By Frank H. Vore, In Charge

The Bureau of Public Relations, sometimes designated as the Bureau of Publicity, has grown considerably in importance and scope during the two-year period ending June 30, 1928.

First operating strictly as a publicity department, for the purpose of supplying newspapers and news agencies throughout the state with authentic information and real news stories of the various activities of the Division of Fish and Game, it has developed to the point where the director is presumed to be the "contact man," operating between the division and not only the newspapers and news agencies but also between many organizations and individuals in an intensive effort to get before the people of California the progressive program of protection and conservation of the natural resources, namely fish and game, that has been inaugurated and is now in operation.

During the first ten months of the period just ended, this work was ably carried on by Major Rolin G. Watkins, who left on May 1, 1927, to enter business for himself in Salinas.

To Major Watkins should go great credit for the establishing of many excellent contacts and for the physical organization of the bureau on a real working basis.

Not only did Watkins prepare and send out good publicity, but he attended countless meetings, where he carried the message of conservation to thousands of interested persons.

During eleven days in February, 1927, Major Watkins addressed seven meetings, and during each month until he left the service on May 1, he was constantly busy, preaching the gospel of conservation as well as sending out his carefully prepared news stories of the division's activity.

Many newspapers were added to the large list with which he started the bureau, and when it was handed over to the present director on the date mentioned it was found to be functioning in fine style.

During the ten months of the biennial period that Watkins was in charge, the state game farm planted a number of pheasants in various sections of the state, and he attended these liberations and secured much invaluable publicity through cooperation with newspapers and sportsmen's organizations at the places where the new game birds were loosed.

The present director has kept up this practice and has found no difficulty in securing the needed cooperation to get the publicity and perfect the arrangements for the liberations.

Watkins also handled the many details connected with the second annual convention of employees held in February, 1927.

The present director came directly to this position from the Fresno *Bee,* where he handled the sport desk for five years. He was and is of course in close touch with newspaper men throughout the state and the stories sent out by the bureau are given general publication.

It was found that considerable gain was made soon in the cooperation given by the metropolitan newspapers. The dailies in San Francisco, Oakland, Los Angeles, Fresno, Sacramento and San Diego started to use and continue to use practically all publicity released by the bureau.

During the past fourteen months the present director has been in charge of the bureau it has been found necessary to make frequent trips to various sections of the state to maintain contacts already established and make new ones when and wherever possible, make friends for the division and explain the present program.

Many addresses have been made wherein this program and the activities of the division have been explained. At the various places visited during the period mentioned it has been found that the people of the state are rapidly becoming "sold" on the work of the division. Field men are doing efficient work and have the confidence of the people in their localities in practically all instances. Through a close contact with newspaper editors and publishers, the director has been able to advise the deputies how to secure the proper publicity for their local activities, and it is reassuring to find that this is being done to a much greater extent than in former years.

The average number of stories sent out monthly is twenty-one. This does not include many "spot" news stories in which the time element is of vital importance. These stories are prepared by the director, and after approval by the executive officer, and if necessary by the Commissioners, are released through the three press associations operating from headquarters offices in San Francisco. If the story breaks in the southern California district, it is sent out through the Los Angeles offices of the same three services—the Associated Press, the United Press, and the International News Service. The director has secured fine cooperation from the press associations and the Associated and United Press bureaus have sent a number of our stories out for national release, in some cases with illustrations from photographs made themselves.

In addition to the above, a story is released weekly to the National Automobile Club for use in its weekly "news bulletin," which reaches over 700 newspapers. These stories are used generally in automobile and travel sections of the papers and are getting much attention.

From the clippings gathered by the clipping bureau that serves the division, it has been found that an average total of 1100 stories per month appear in the newspapers clipped, pertaining to fish and game activities. The careful check made indicates that almost 40 per cent of these are stories sent out by this bureau, while regular stories developed by the papers themselves, received from news agencies or correspondents or prepared by special writers assigned to fish and game work make up the balance. The total is growing larger and as it grows it is found that the division publicity is getting more and more recognition.

It is believed that this fine cooperation is being builded due to the established policy of sending out stories that really have news value, and never giving any newspaper an exclusive release. When it is necessary to send out what might be termed propaganda, a news angle is worked out that assures the story of being published. In some instances personal letters are sent the editors explaining the importance of a story and the reason why space is requested. These letters have met with a ready response, and the director feels safe in declaring that the bureau is in a position to get a generally favorable reception throughout the entire state with any publicity program that may be contemplated.

While there are no exclusive releases, a policy has been made that in the cases where a newspaper or news agency decides to develop a story "on its own" every assistance is given to make the story a success.

An arrangement has been made with the various San Francisco and Oakland radio stations to broadcast important messages in cases of emergency. While we have taken advantage of this offer only once, when we covered the state with an appeal not to kidnap young fawns, it is an important contact, and may be used at any time when we have an urgent message to get before the people of the state.

Through a working agreement with the International News Reel, the Hearst weekly news film service, we are assured that camera men from this service will work with us on any worth-while story, and see that the films are given general circulation.

A part of the work of the director is the gathering and editing of material for the Service Bulletin, issued monthly to the employees. The bulletin is growing in size and popularity each month.

Through associations made during the third annual convention of employees the director has formed a close alliance with the deputies in the field, and they are all very helpful in securing information needed to continue the work of informing the public of the activities of the division.

The convention held February 28, 29 and March 1, was highly successful. The field men went back to their posts much impressed with what was learned in the three days of intensive work done here, and the director of public relations was glad to be able to be of some help in the handling of what proved to be a very fine meeting.

The bureau has operated on an economical basis, expenses have been reduced to a minimum and the year ends with a surplus on hand in the budget allowance made for the past year. Whenever it is possible through cooperation with newspapers, organizations and individuals to secure necessary results without expense to the division, it is done and only such expenses are incurred as are for the best interests of the work at hand.

With the continued operation of the bureau on progressive lines, and by the maintaining of the good contacts established and the constant striving to make new ones, it is thought this bureau will function even more efficiently and carry out the important work of advising the people of the state regarding the activities of the Division of Fish and Game in a much more extensive manner during the years to come.

The value of good publicity can not be doubted. The bettering of relations between the division and those organizations and persons that are interested as well as those who have not as yet learned it is vital for them to be interested in the conservation and protection of our natural resources is of paramount importance.

Plans are under way to extend the activities of the bureau when and wherever possible, and with the continued cooperation of the newspapers and other agencies throughout the state, it is reasonably expected that the bureau will grow in importance and earn increased respect not only for its activities but for the Division of Fish and Game.

REPORT OF THE BUREAU OF EDUCATION

By H. C. Bryant, In Charge

PERSONNEL

Until the past two years, the Bureau of Education has been largely a one-man department. Recently, however, there has come the first real opportunity for expansion in personnel and a resultant increased service to the public. It seemed best to give attention first to the growing editorial work connected with the publications of the Commission and to the better care and distribution of motion picture films. Mr. Rodney Ellsworth came to the bureau with a background of experience in educational work in Yosemite and Sequoia national parks and as the author of a well-known treatise on the sequoia. The building of a worth-while technical library for the use of department heads and conservation workers was the next duty given the bureau. Mrs. Bessie W. Kibbe, long a student of birds and with considerable business experience, was secured as librarian. Need of increased knowledge of the life history and habits of game and nongame species, the necessity for a study collection of birds to be used for reference and for illustration, and the need of additional investigations concerning the relation of birds to agriculture led to the appointment of Mr. Donald McLean. Mr. McLean came to the bureau with a splendid knowledge of field zoology, leaving a position as assistant park naturalist in Yosemite National Park to accept the position with the division. Demands for lecture programs in the schools led to the appointment of Mrs. O. P. Brownlow, who has accomplished splendid results in stimulating the teaching of conservation in elementary schools. In the spring of 1928, the formulating of a wide program of education in the schools and in such organizations as boy scouts and camp fire girls was placed in charge of Mr. George Holmes. Miss Madeleine Monell has continued as secretary. The increased service which the bureau has been able to render has been gratifying, but the perturbing thing is that the demands for services now far exceed the ability of the augmented staff to handle them.

In January, 1927, the office of the bureau, which for thirteen years had occupied a room in the Museum of Vertebrate Zoology on the University of California campus, was moved to the headquarters of the Division of Fish and Game in the Postal-Telegraph Building, San Francisco. A large room for a library, an inner office and a small storeroom were assigned. These quarters have proved too small for effective work.

Outstanding in the accomplishments of the past two years have been:

1. Notable increase in the lecture service.
2. Building of the first reference library owned by the division since the San Francisco fire in 1906.
3. Beginning of a useful study collection of bird and mammal specimens.
4. Increase in the library of films and wider distribution thereof.
5. An organized nature educational program for public schools as a demonstration of the usefulness of such a program.
6. Increased service to boy scout, camp fire and like organizations.
7. Augmented program of conservation lectures in schools.

8. A program of field investigations designed to furnish data relative to life history and habits of game and nongame species and to the relation of birds to agriculture.

9. In addition to serial publications there was issued a new series of hand bills detailing the activities of the fish cultural department, of game propagation, and a general one on the work of the division.

LECTURES

In order that more lasting results be obtained, effort has been made to outline and to execute organized or continuous programs. Several years ago a nature guide service was developed in Yosemite National Park. More recently a school for the training of nature guides and teachers of wild life conservation was established. At present a man has been retained to plan and to organize suitable educational programs for various associations. In addition to these major projects, the lecture program has been greatly extended. One staff member, Mrs. O. P. Brownlow, has devoted her time to nature education in the elementary schools. In the city of Oakland alone she visited 52 schools, gave 232 lectures to 13,759 pupils and teachers. As a result of this work Oakland is planning a nature study program based on the conservation of natural resources. A lecturer systematically visited the elementary schools of Ventura and Imperial counties. A fine response was secured from foreign children who especially need conservation ideals. Another staff member has regularly covered the fish and game protective associations, giving a series of lectures arranged by deputies. Materials and speakers have been furnished for radio programs.

As in the past, motion pictures have formed the main means of illustration. More recently it has been possible to utilize study skins of birds, suitably enclosed in celluloid tubes. Additional exhibit materials are being prepared.

A training course for boy scouts preparing to pass the merit badge test in bird study and conservation has been given each fall for the scouts of Piedmont and Berkeley. Plans are at this writing complete for a wild life conservation camp for boy scouts to be located in Yosemite National Park. A ten-day course of instruction will be given which will include first-hand studies of game and fish. The expense will be partially defrayed by the Division of Fish and Game. Series of six fish and game lectures have been given each spring in a course in Forestry I at the University of California. As a further training, the class, divided into sections, has been given first-hand instruction in the field. As these students spread throughout the state and into many professions, this work has the merit of being fundamental and of being the means of disseminating conservation ideas throughout the state.

The biennium has shown a marked increase in demand for lectures by service clubs and by the schools and by the Masonic lodges. In San Francisco several of the latter inaugurated a "sportsmen's night," the special features in each case being a lecture, illustrated with motion pictures, delivered by a representative of the division and a banquet at which a reindeer stew was served.

Considerable aid in the educational program has been given by individuals outside of the Bureau of Education. Individual members of the Commission, the executive officer, and Mr. Walter R. Welch have given very valuable assistance.

The end of the biennial period found the attendance at lectures averaging about 12,000 persons per month. The wideness of the field of activity is indicated by the following summary:

Attendance Record of Lectures, Bureau of Education

July 1, 1926, to June 30, 1928

Organization	*Number of Lectures*	*Attendance*
High schools	100	53,914
Grammar schools	100	26,410
Universities and colleges	6	1,531
Civic and public	19	2,809
Service clubs	30	3,012
Masonic and other lodges	16	2,195
Fish and game protective associations	50	13,782
Boy scouts, campfire girls, etc.	17	1,031
Radio	3	----
Miscellaneous	48	5,057
Totals	389	109,741

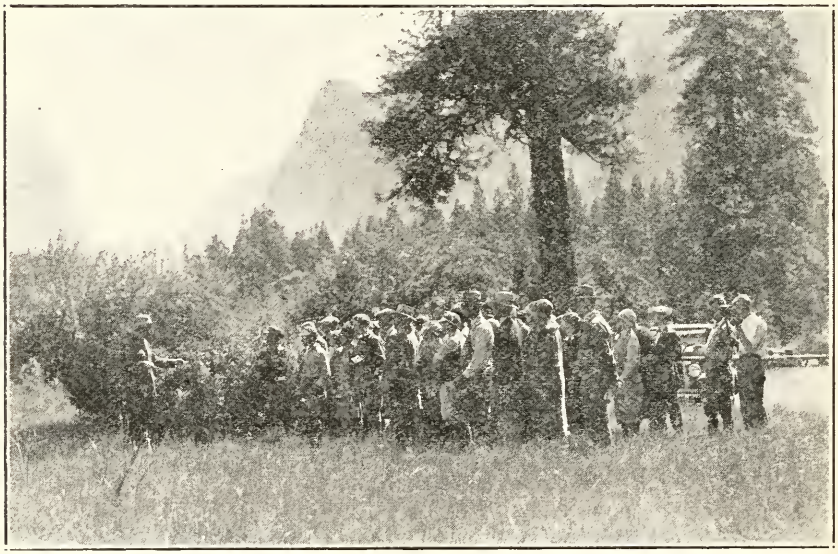


FIG. 25. Learning conservation methods first hand. A nature guide party in Yosemite receiving instructions from a nature guide, summer of 1928. Photograph by J. V. Lloyd.

SUMMER RESORT EDUCATIONAL WORK

Educational activities during the summer season have been concentrated in Yosemite National Park where thousands of summer vacationists were given conservation messages and a chance to study natural conditions first hand. The cooperative arrangement of former years has continued, the National Park Service employing a staff of eight in order to carry out an extensive program of lectures and field trips. Beginning in the summer of 1927, the added duty of acquainting the public with fish propagation was undertaken at the new Yosemite

Hatchery. A nature guide is on duty for several hours each morning and afternoon during the summer giving instruction to the numerous visitors.

The Yosemite School of Field Natural History graduated a class of twenty students. The course consists of six weeks of study on the floor of Yosemite Valley with emphasis on field research, and an added week of study at timberline in the High Sierra. The graduates from this school with their added training have been able to stir interest in nature education and conservation in many different parts of the state. A number of graduates have found positions as nature guides in national parks, state parks and summer camps. All return to their work ready to spread interest in conservation of natural resources.

Attendance Record, Yosemite Nature Guide Service

	Field trips		*Lectures*	
	Number	*Attendance*	*Number*	*Attendance*
July-August, 1926	253	3,051	188	40,453
May-August, 1927	755	16,213	878	167,907
May-June, 1928	226	2,904	55	24,805
Totals	1,234	22,168	1,121	233,165

Beginning in the summer of 1926, a nature guide service was established in California State Redwood Park in Santa Cruz County. This was done at the suggestion of a member of the State Board of Control and on the solicitation of the Redwood Park Commission. Mr. J. B. Newell and Miss Emily Smith, both graduates of the Yosemite School of Field Natural History, and with actual experience in Yosemite were employed. Evening lectures dealing with fish and game conservation and field trips for both adults and children were offered. The public showed its appreciation of this service and it was continued in the summers of 1927 and 1928. The success of this work in California State Redwood Park has caused a demand for the widening of activities under the new Division of State Parks.

Attendance Record, California State Redwood Park, Season 1927

	Field trips	*Lectures*
June	581	60
July	1,616	9,175
August	547	3,500
Totals	2,744	12,735

VISUAL EDUCATION

The end of the last biennium found the bureau with a series of worn-out motion picture films. It is gratifying to report that some of these have been replaced and many new ones added. A partial reel devoted to fly-casting was the first addition. Later some splendid pictures of game and nongame birds were secured from Mr. Donald Dickey of Pasadena, and from Mr. E. S. Cheney of Oakland. This made possible two reels, one entitled "The Song Birds of California" and the other "Some Nongame Birds of California." Additional films depicting the grouse, elk, deer, and certain birds were procured in the Yosemite region. Beginning in the fall of 1927 Mr. Sidney Snow was employed

to make a series of feature films. The first procured was a four-reel film showing propagation of game birds at the state game farm. Later a five-reel film outlining trout culture at the Mount Shasta Hatchery, and fish distribution was taken, and a two-reel feature film showing salmon operations on the Klamath River. Mr. E. S. Cheney was also employed to secure films of the mountain sheep and antelope. An especially interesting film of mountain sheep was secured in Inyo County. The animals are shown drinking at a desert spring. Many scenes were obtained only after waiting hours in the blind. Additional films of nesting waterfowl were secured at Honey Lake, in Lassen County, near the place where a herd of antelope was photographed. These feature films have been in constant demand for showing at meetings of fish and game protective associations.

The demand for motion pictures from high schools and sportsmen's organizations has necessitated the installation of a regular booking system. On several occasions practically every available film has been loaned and these were being shown in some seven or eight different parts of the state. There is a growing demand from county agents and horticultural commissioners for the use of films to be presented at farm bureau meetings. In many instances deputies of the division have organized their own programs and utilized films in various sections of their territory. A Holmes portable projector now makes showing of films possible. The collection of lantern slides for illustrating lectures has been materially increased. A splendid collection of approximately 200 mounted specimens of birds was donated by the Golden Gate Park Museum together with three fine display cases. The specimens have already been put to good use in connection with exhibits. Others are on display in the office.

Exhibits. There has long been need of a portable exhibit for installation at county fairs. This was partially met in the fall of 1927 when the bureau had constructed an exhibit entitled "A Forest Tragedy." The main feature of the exhibit, which was enclosed by a painted curtain and a background of vegetation, was a dead doe at a water hole with her two fawns left to starve, the evident result of a careless hunter. This exhibit, installed at the State Fair at Sacramento, drew considerable and favorable comment. Later it was erected at the Ventura County Fair and the Fresno District Fair, and twice in San Francisco at the Pacific Foreign Trade and Travel Exposition and the Food and Home Appliance Exposition. Unfortunately, this exhibit proved to be very heavy and ponderous and consequently difficult to transport. Furthermore, considerable time has to be spent in securing the scenic foreground of vegetation and in gaining a realistic effect with the use of the stuffed animals. In order to obviate this difficulty, a series of small portable exhibits (4'x 3'x 2') which fit into cases and are easily transported were planned. The first one to be completed showed mountain sheep in miniature on a desert range. An attractive feature of this exhibit is to be found in the fact that the labels and some of the animals are kept in motion by the action of an electric motor. Thus the passing observer is drawn to the exhibit by the movement which attracts the eye. A second case contains an exhibit showing the Mount Shasta Hatchery. A motor truck loaded with fish cans moves to and from the entrance. The brood ponds are to be seen and Mount Shasta forms a beautiful background. Plans are complete for display of these exhibits

in all the larger cities. There is much favorable comment on these portable exhibits and others will be built.

There has long been needed a study collection of birds and mammals, both from the standpoint of reference and of teaching materials. During the biennium, the miscellaneous collection, which had accumulated, was renovated, properly labeled and housed. To this original set of study skins of birds, there have been added numerous specimens bringing the total to 365. Among them are to be found some which are particularly useful for study. Three varieties of tinamous from South America are now to be found in the collection. Several of the rarer hawks have been added and specimens of shorebirds include a mountain plover, and in the specimens of geese, a black brant. Few things have so stirred the interest of deputies in the direction of better knowledge of the wild resources of the state than has this collection of bird skins.

RESEARCH AND FIELD INVESTIGATIONS

With the assistance of Dr. K. F. Meyer of the University of California, investigations relative to animal disease were begun in 1927, and finally some of the research problems concerning game were centered in a separate research bureau. There have still been allotted to the Bureau of Education economic studies relating to agriculture.

For several years there has been increasing complaint that small birds were damaging fruit buds in eastern Tulare County. When damage was reported in the fall of 1927 an investigator was sent to look into the situation. It was found that there was a concentration of birds in that general locality and that damage to fruit buds was real. Helpful suggestions were offered ranchers as a means of protecting their crops from attack and the investigations are to be continued another year. In order to place on a better basis the arguments pro and con as to the depredations committed by predatory species, data relative to the food of hawks and owls and other predators are being collected. Interrelations between predatory species and the animals preyed upon are not well known and more dependable information is being sought. Staff members have also participated in investigations relative to game refuges, poison campaigns in relation to game and to fur-bearing animals.

LIBRARY

The accumulated library of the division was destroyed in the San Francisco fire of 1906. Thereafter, no attempt was made to rebuild it. Beginning in 1927, the Bureau of Education was given the task of establishing a useful reference library. A librarian on full time has devoted her energies to classifying and cataloging the rapidly filling book shelves. Books have been cared for in glass front sectional bookcases and bound magazines and miscellaneous pamphlets have been placed in cases in metal stacks. A simple system of classification has been utilized so that technical experience is not required in order to locate the materials sought. Nearly four hundred interoffice and outside employee call loans have been made this past year. Files of laws of all states and Canadian provinces and biennial reports of other fish and game commissions have been completed as nearly as possible. Back volumes of about sixty sporting and scientific magazines have been suitably bound. A subject bibliography is in process of formation and

is functioning to such extent that readily answerable are questions asked by the general public concerning fish ponds; identification, seasons, drying, acclimatization and diseases of fish; identification, economic value, poisons, migration, songs, houses, eggs and life history of birds; game bird farming; fur farming; muskrats, hunting, deer, mountain lion, squirrels and trapping of animals, as well as those regarding alligator farming.

Outstanding in the accessions are the following books:

Nature Library, Doubleday Page & Co., 17 vols.
Birds of California, Dawson, 3 vols.
Series of British Birds.
Ducks of the World, Phillips, 4 vols.
Natural History, Thomson, 3 vols.
Text Book of Zoology, Parker and Haswell, 2 vols.
Pheasants, Their Lives and Homes, Beebe, 2 vols.
Set of publications of California Academy of Sciences.
Almost complete file of Cornell Rural School Leaflets.
Guide to the Study of Fishes, Jordan, 2 vols.
Marine Products of Commerce, Tressler.
U. S. Bureau of Fisheries Reports and Bulletins.
California Mammals, Stephens.
Life Histories of Northern Animals, Seton, 2 vols.

EDITORIAL AND PUBLICATIONS

Eight numbers of the quarterly, *California Fish and Game*, comprising 617 pages, have been issued. Special numbers published were Game Propagation Number, April, 1927, Commercial Fisheries Number, January, 1928, and Convention Number, April, 1928. The policy is to make the magazine one which teaches conservation and acts as an historical record of conservation progress in California. *California Fish and Game* is widely used for reference by high school students. The mailing list for this magazine was completely revised in the fall of 1927. The names dropped from the list have been replaced by numerous applications which have been received from members of fish and game protective associations and other individuals.

The biennial report in the fall of 1926 contained ninety-eight pages and thirty-eight pages of statistics.

Two additions were made to the series of Teachers' Bulletins. A revised edition of "Bird Study for California Schools" was issued in April, 1928. The edition of 10,000 will be quickly exhausted, judging from the demands therefor. This bulletin furnishes the instructor with interesting and valuable suggestions and materials for teaching. There is also included a guide to the study of the commoner California birds, a list of birds that everyone should know and a bibliography. Scientific names have not been used and the bulletin has filled a long-felt need. A smaller bulletin dealing with owls and their economic relations is ready for the press. A fish bulletin dealing with the California sardine, contained 222 pages.

A small booklet containing colored plates of hawks was secured from the American Nature Association. This was placed in the hands of teachers and others interested in learning more about predatory species.

New series of handbills suitable for distribution at fairs and other meeting places were issued in the fall of 1928, also one summarizing the work of the various departments of the Commission and special ones devoted to game bird propagation and fish propagation.

REPORT OF THE BUREAU OF GAME FARMS

By August Bade, In Charge

About June 15, 1926, the game farm at Yountville became a reality. The Department of Public Works had completed a 472-pen rearing field covering 7⅓ acres, and also a section of 48 breeding pens. In addition to this construction work, five buildings of various types were erected—a superintendent's cottage, a mess hall, bunk house, poultry house, and a combination feed and cooking room.

Three other buildings have been added to the equipment since then, including an eight-car garage, a bantam poultry house 12 x 100 feet, and an egg and incubator room 16 x 18 feet. Additional breeding pens

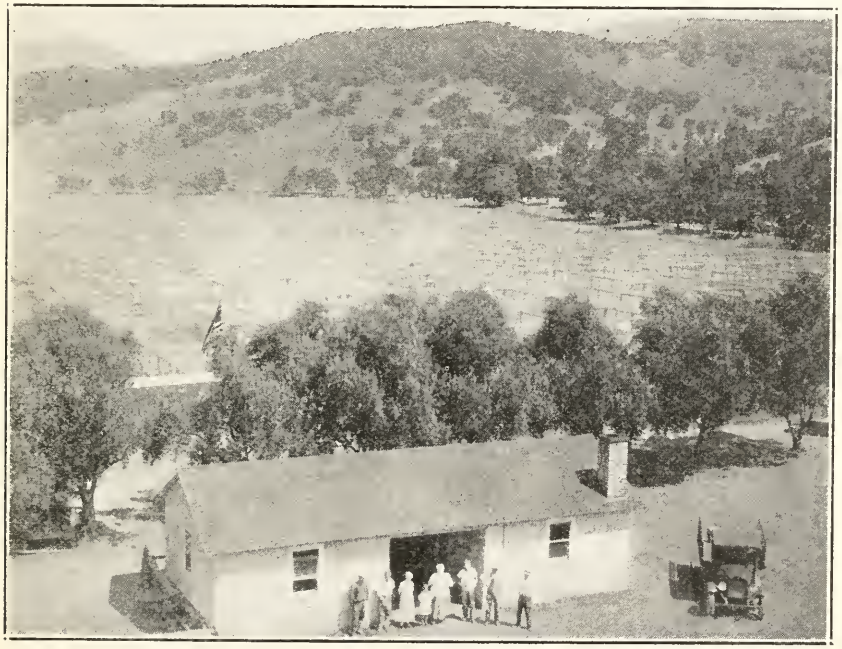


Fig. 26. Yountville Game Farm, showing cooking room, employees and pheasant pens in the background.

for pheasants, partridges, and turkeys have also been constructed. The present pen capacity of the plant is 624.

Early in 1926, 200 ring-necked pheasant hens and 30 male birds were purchased from a private breeder in Oregon and a number of valley quail were trapped in Napa County, and these birds formed the foundation breeding stock of the farm. A few pairs of fancy pheasants were purchased and public spirited individuals donated or loaned birds to the farm so that a cross-section of the weekly report as of July 1, 1926, showed a bird population as follows: Ring-necked pheasants 2800, silver pheasants 13, golden pheasants 4, Reeves pheasants 2, Lady Amherst pheasants 2, Hungarian partridges 4, valley quail 149, wild geese 6, and peafowl 3.

A year later, July 1, 1927, the weekly report gives the following list of birds: Ring-necked pheasants 7451, silvers 39, goldens 52, Reeves 11, Amherst 2, Hungarians 66, valley quail 128, wild geese 5, peafowl 11, native grouse 1, and mallard ducks 20.

The report of June 22, 1928, the week this report is written, shows a bird population as follows: Ring-necks 7185, silvers 71, goldens 62, Reeves 19, Amherst 2, Hungarians 61, valley quail 284, mountain quail 3, peafowl 10, versicolors 415, wild turkeys 235, bamboo partridges 48, geese and ducks 45, South American tinamou 12, and domestic poultry for hatching 1027.

From the figures of these reports and the experiences of several years we are naturally led to the conclusion that game bird farming is

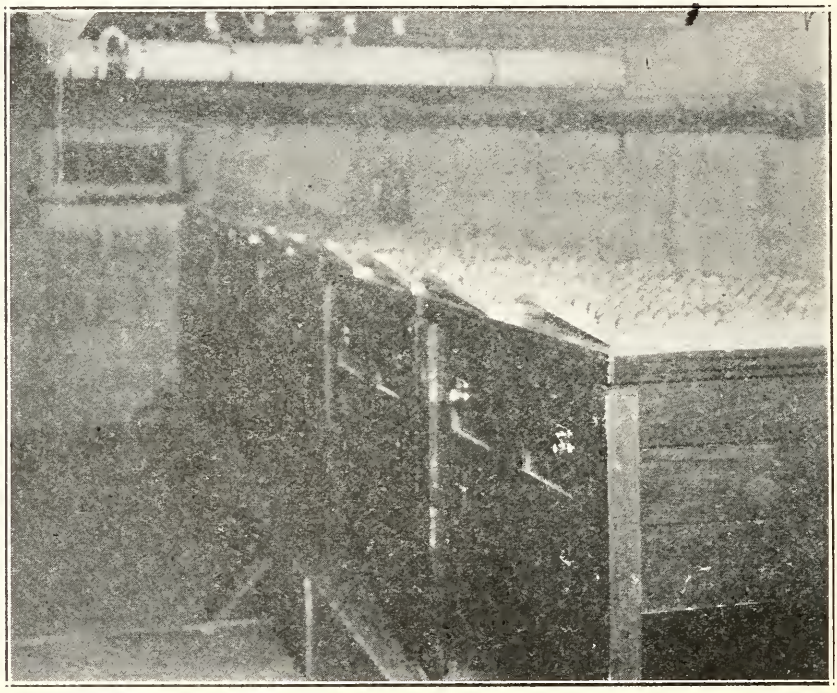


FIG. 27. Incubators at the Yountville Game Farm supplement hatching by hens. A view in the incubator room.

much like any other line of industry: You will get out of it just about what you put in multiplied by personal knowledge, interest in the work, and a careful attention to detail. Expressed in another way, game bird farming is simply helping the work of nature in a scientific way. Man has by his own acts created a condition that makes it impossible for nature to carry on in the natural way, so it is necessary to lend the helping hand of science and in a limited way make amends for the havoc and disorder thus created.

In many sections of the country we have seen the supply of native game birds gradually fade from the picture and in many instances never to return. However, in some places, due to natural topography,

the original supply has lasted longer than it has in other sections. California, with its millions of inaccessable acres of domain, is the last state of the Union to have to come to artificial propagation. But we are now face to face with the problems that have confronted other states, and in many cases they have been solved in a more or less satisfactory manner. There is no doubt but we will solve our problems to the satisfaction of the millions or more sportsmen.

VALLEY QUAIL

The California valley quail seems to be one of the native game birds that is imbued with the determination to hang on. It is still found in many sections of the state in goodly numbers. Nothing need be said concerning its gameness and ability to care for itself. The fact that it is still with us is proof enough. It is our judgment that if

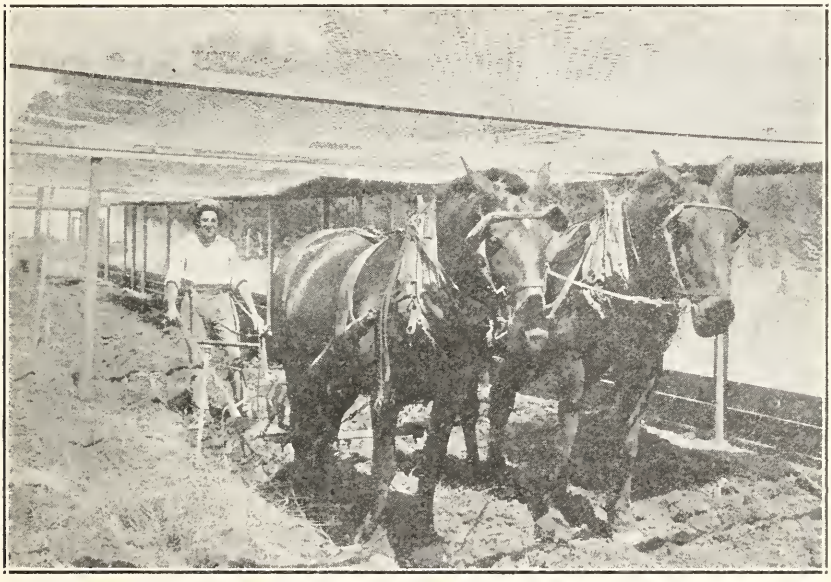


FIG. 28. Pheasant pens are renewed by cultivation and planting. Photograph by Sidney Snow.

suitable refuges were created and the overstocked areas trapped and the surplus stock released in these protected sanctuaries where they would have protection and suitable breeding grounds, the species could be perpetuated and possibly brought back in numbers equaling the days the old timers like to tell us about.

There are countless places in the state where valley quail can be put into an environment perfectly natural to them and in which they will reproduce in a normal way. In this way the quail population can be very considerably increased at a very low cost in money and labor.

The next problem we have to deal with is the vast areas of cultivated lands now occupied with orchards, vineyards, and dairy projects. To find a bird suitable for this work we must look beyond

our own borders. The fact that our own native species have been eliminated by this condition of agriculture automatically disqualifies them for competition. At the present time two birds offer themselves as candidates for this job. One is the ring-necked pheasant and the other the Hungarian partridge. Both have qualified and made good to the entire satisfaction of sportsmen in many localities.

The ring-neck comes to us from one of the oldest civilizations of which we have any record, and the Hungarian is likewise well acquainted with civilized conditions. Much has been written concerning the introduction of exotic species and many arguments have been put forth both for and against. But the fact remains that most civilized countries are now using both of these game birds as the two major elements in their programs of restocking.

Because of its breeding habits, being polygamous, the ring-necked pheasant lends itself to any program of artificial propagation better than most any other bird. Under ordinary conditions the pheasant

FIG. 29. Valley quail are raised at Yountville Game Farm. These are ready for planting. Photograph by Sidney Snow.

hen will lay at least fifty eggs for the season and the fertility will average 85 per cent. This is an increase of three times their natural reproduction in their native wild state.

The Hungarian partridge has long been considered by sportsmen the gamest bird found in the fields, and very well equipped in every way to take care of himself. Then, too, they are very prolific, and in a very short time will populate any area into which they are transplanted. In the past ten or twelve years many thousands of them have been brought into different parts of North America and in all cases they have multiplied rapidly. Our own neighboring states of Oregon and Washington are nearby examples of what this bird means to the pleasure of the sportsmen.

Recent checks on reproduction records of pheasants, quail, and partridges, show the average of pheasants and quail to be eight birds for each female, while the average of the partridge is sixteen. This is from checks made on broods of wild birds over a period of three years in the state of Washington.

For game farming, or domestic rearing, the partridge does not come in the same class as quail and pheasants. This is due to a peculiar habit of mating. Partridges are monogamous and the matings must be mutual. In a measure this is also true of quail, but they are to some extent pliable in this regard, and yet it may account for the fact that some years quail do very well under a domestic condition and other years the results are not so good.

The best successes with partridges has been had where the birds were liberated in an area that was suitable for them and they were allowed to pair and rear their broods in their own way. Where successful stockings have been made this has been the plan. Some success

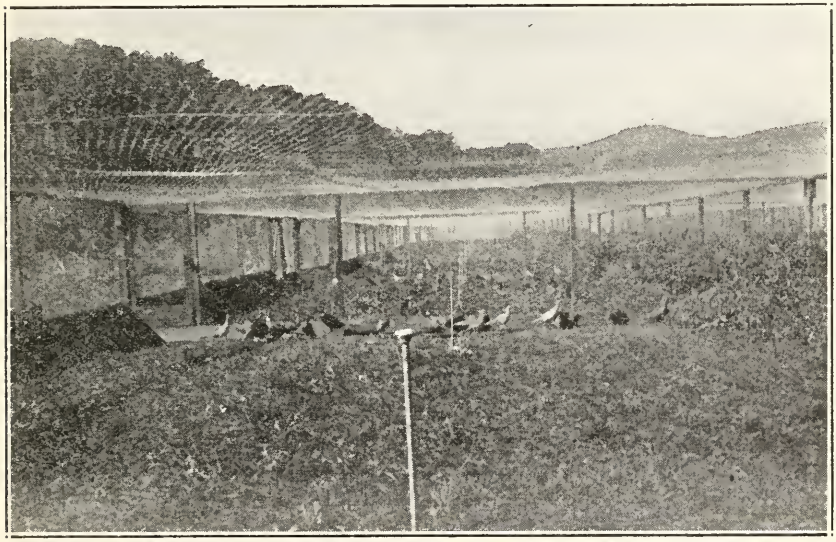


FIG 30. Ring-necked pheasant breeding pens, Yountville Game Farm.

has been had from hand-reared birds but it has always been limited and in the end is more expensive than the other method.

The importation of these fine game birds is only limited by the numbers the native trappers are able to take. For the year 1928 it is estimated by one importing firm that they will send to the United States forty thousand of these birds. The price will range from $8.65 to $10 a pair f.o.b. New York. No program of conservation and propagation is complete without the ring-neck pheasant and the Hungarian partridge.

Sportsmen have varied ideas with reference to what should and should not be propagated. Many have expressed a desire to have the wild turkey added to the game bird list of California. Mr. George O'Connor of San Francisco, has been an ardent advocate of this idea, and at the start of this present season he made it possible for

us to get the initial breeding stock and we have at the present time a flock of 200 young turkeys. Suitable areas will be found for them and they will be given a chance. The argument, and it seems to be a sound one, is, if they do well in Arizona and Colorado, why can't we have them in California?

With this same idea in mind of trying to find some bird for the more arid sections of the state where it is too dry for either quail or pheasants, we are trying the South American tinamou. This is a bird from Argentina, and may possibly fit into our program of restocking shot-out covers. The bamboo partridge of China is another bird that may find a place with us and a small stock of these birds has been secured.

In so far as our time and means will permit, we will try out new species from time to time in an effort to provide sport for localities where very little is had at the present time.

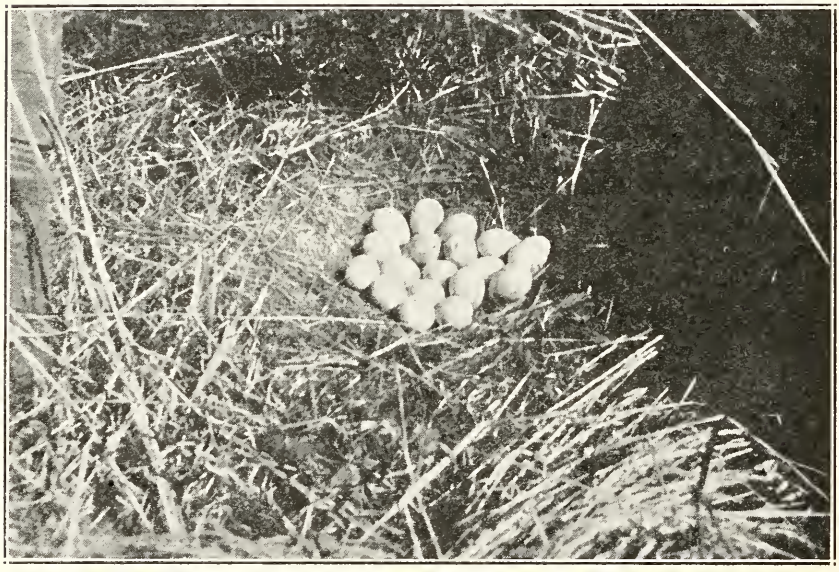


FIG. 31. Nest and eggs of wild turkey, Yountville Game Farm.

MANNER OF PLANTING

It is not only necessary to produce good healthy birds on our game farms, but they must be transplanted from the farms to natural cover that will afford them the food and protection necessary for their well being. In order to more successfully meet this problem it was deemed wise to create a number of sanctuaries or game refuges in which the birds could be released and have the protection as well as the natural food necessary for their existence.

A survey was made in 1926 and sixteen refuges created and planted with pheasants. All of these sanctuaries are marked with signs of warning so that they are easily identified.

As the work progressed and the output of the farm was increased it was necessary to find forty-one additional places for planting in

1927. All of the areas planted in 1926 were restocked in 1927 according to plans that had been previously adopted by the Commission.

NUMBER OF BIRDS PLANTED IN AN AREA

It was also deemed expedient to make all plantings with a sufficient number of birds so that they might be easily identified. Following this rule no plants were made where less than one hundred birds were used. Some of them included as many as two hundred and fifty. This made it easy for the Commission or interested sportsmen to check up on the plants and get definite information on the progress of the birds. If only a few pairs are placed in an area and anything happens to a few of them the identity of the plant is lost.

KIND OF GROUND SUITABLE FOR PHEASANTS

Primarily the pheasant is a bird of the valley or meadow regions. It is nearly always safe to say that dairy lands are well suited to these birds. Low grass and weed cover seem to suit them better than

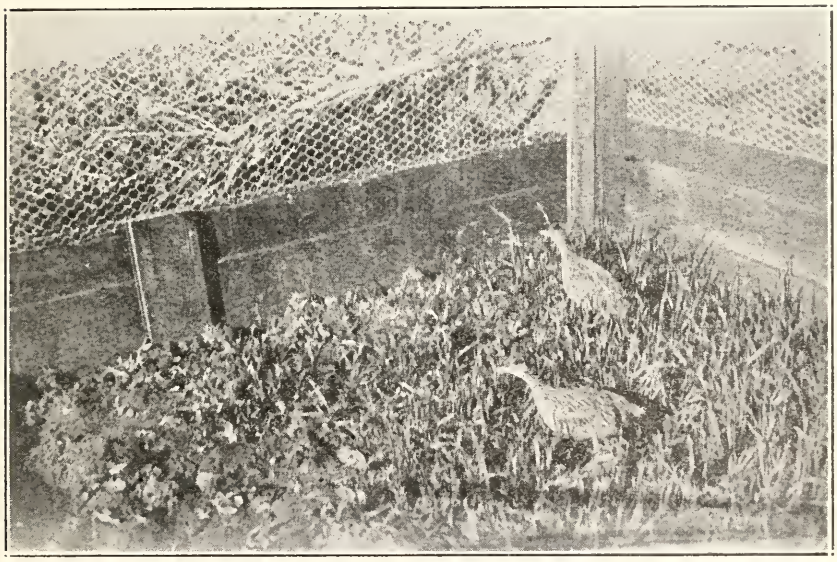


FIG. 32. At the Yountville Game Farm experiments are being made in the propagation of various species of tinamou, famous South American game birds.

brush or the more wooded sections. Alfalfa fields are much to their liking because of the excellent cover and the further fact that insect life, their principal food, is found there. It is true that they will use higher ground for morning and evening feeding, but the greater portion of their life is spent in the lower country.

On the contrary the Hungarian partridge will seek the bench lands and the stubble fields and in general ranges higher than the pheasant. Partridges also like grass cover in which they pass the greater part of the day hidden from their natural enemies.

EDUCATION

Believing that true progress and permanent success is based upon a program of education, the Bureau of Game Farms has taken advantage of every opportunity to acquaint the public and the sportsmen with this work of artificial propagation. One means of attaining this end is in public exhibitions at state and county fairs. So far as possible we have made these exhibits purely educational. Pens of the different birds are shown in as natural an environment as possible with an attendant present to explain and answer questions asked by a curious public. With the use of mounted specimens it is also possible to show the natural enemies of the different birds or animals as the case may be. For instance, at the recent Orange Show a fine specimen of a mountain lion was shown in the act of springing upon a live deer. In the same way many of the hawks, owls, and ground vermin that take a large annual toll from the numbers of the game birds were shown. The paid attendance at the Orange Show was given at three hundred thousand. Most of these people saw our exhibit, and from letters received it is indicated that much favorable interest was created.

In conclusion, we strongly recommend the creation of more game refuges where the output of the farms may be planted and the birds permitted to multiply in a natural way, and from these sanctuaries populate the adjoining territory.

REPORT ON GAME STATUS AND GAME PROTECTION

By J. S. Hunter, Assistant Executive Officer

Though California does not bear the same reputation as a hunting state that other sections of the country have, yet everything considered, California sportsmen have very little cause for complaint regarding the number of species and abundance of game.

The successful settlement of California in the early days was largely due to the fact that there was an abundance of game in practically all sections. In those olden days there were species that occupied territory that as time went by became more valuable for agriculture and other industries. Game, like the Indians, had to give way to industrial development. The elk, like the buffalo in the middle west, ranged over the rich valley land that under the changed conditions would produce tons of meat and agricultural crops where pounds were produced before.

Fortunately for the lover of wild life and the great outdoors, all of California's 100,000,000 acres is not agricultural land. In fact, the major part of it remains much the same as in the days of gold in spite of our 5,000,000 population and our thousands of miles of modern roads.

However, more and more careful conservation work must be carried on and more stringent laws must be adopted from time to time in order that we may not draw too heavily on the supply.

Serious game protection in California did not commence until about twenty years ago when the hunting license act was first adopted. Previous to that time there was very little money for the employment of deputies and as a result there was a very slack observance of the laws creating closed seasons and adding other restrictions.

With the added money coming in from license sales, patrol officers were employed in nearly every county and there gradually came about better conditions. Today, game protection and conservation is a very important problem in California. With the population four times what it was twenty years ago and with modern transportation reaching the most out-of-the-way places within a few hours, it is more and more necessary to have the cooperation of everyone interested in conservation.

California has a population practically equal to that of the ten other western states, with an area approximately one-sixth of those states. With a large population there are more potential violators and there is also a greater drain on nature's storehouse. This is somewhat offset by the greater revenue derived from hunting and angling licenses allowing the employment of more men in the field and providing generally for better conservation conditions.

DEER

At the last session of the legislature a deer tag license law was adopted. This act requires all deer hunters to provide themselves with a deer tag license in addition to the regular hunting license. The licenses, as the name implies, are in the form of a tag that must be tied immediately onto the horns of any deer killed. A post card that is attached

to the tag must be filled out with certain information regarding the location where the deer was killed, and other details and must be mailed without delay to the Division of Fish and Game. Through this system much valuable and interesting information has been secured. The post card return shows that 19,507 deer were killed and reported. The actual kill was probably in excess of this but just what error there is can not be computed, but as years go by a better understanding of the deer situation will be obtained.

The records show that contrary to the general idea that prevails in some sections that there is a scarcity of deer, a surprising percentage of well antlered deer are killed. A tabulation of the record shows that 46 per cent of the deer killed were forked horns, 29 per cent were three pointers and 24 per cent were four points or better.

Deer were killed in every county of the state except San Francisco, Sacramento and Sutter. In Los Angeles County 425 were taken. Within 50 miles of San Francisco over 1000 were killed and within 100 miles over 3300. Fifteen per cent were killed in Siskiyou, Modoc, Shasta and Lassen counties and 20 per cent in Marin, Sonoma, Lake, Mendocino, Solano and Napa. When the area of these counties is considered, it is clear that the upper coast has the heaviest deer population in the state. The four northeastern counties have an area of 18,468 square miles, while the six upper coast counties have only 8493 square miles.

We have every reason to believe that a conservative estimate of the number of deer in the state is over 400,000. With this number there can be a heavy natural drain and kill by hunters and still not endanger the supply. There has been considerable apprehension that the deer of Modoc and Lassen counties have been so greatly reduced that there was danger of extermination. From recent information secured by competent observers in both counties there is good reason to believe that the deer population of these two counties exceeds 40,000, while the reported kill in both counties was only 806.

WATERFOWL

Last year was a better duck year than the year before. Water conditions were better than in many previous years, with the result that more birds wintered in the state.

At the beginning of the season a flock of over 2,000,000 birds rested on the water of Suisun Bay. Shooting was not as good in the Sacramento Valley, particularly on the west side. As usual, this was on account of the fact that water conditions were better in the San Joaquin Valley and the birds went there.

The chief cause for the decrease of ducks in California is the changed conditions that have been brought about by the reclamation of marsh lands and the consequent destruction of breeding, feeding and loafing grounds. Dry ground will not hold or attract ducks. Practically the only duck ground that is in anywhere near the original condition is that which is held by duck clubs.

It has been said that the marsh lands that have been drained have been compensated for by the additional water areas created by storage for power and irrigation. Most of these, however, are not in sections of the state frequented by ducks and consequently do not offset the loss of natural marsh. California is almost on the extreme southern

edge of the breeding range and only a very small per cent nest in our state. In fact, it is quite probable that 90 per cent nest to the north of the Canadian line. It would be interesting to know just what has happened in this great area during the past twenty-five years. What percentage of the original breeding ground is left? What is the annual crop? Until we know something about the number of ducks that are produced every year and the annual toll and natural loss from disease and other causes, our conservation work as far as waterfowl is concerned will be largely guess work.

A great step forward in the protection of waterfowl was made when the federal law stopped the sale of ducks. Up to that time hundreds of thousands of ducks had been sold every year. The San Francisco markets alone consumed from 300,000 to 500,000 ducks. Throughout the state it is probable that 1,000,000 ducks were sold until the federal law, and later the state law, stopped this heavy drain. Today, while there are some ducks sold, the number does not amount to 1 per cent of the sale in olden days. Geese are in need of further protection. There should be either a closed season or the shooting of geese over live decoys should be forbidden.

QUAIL

During the 1925 session of the legislature the season during which quail could be killed was shortened to the month of December only, in all parts of the state except district 1½. This provided a season at a time when the birds were fully developed after the rainy season had commenced so that flocks would not be concentrated around waterholes, and at a time when sportsmen are busy with the holiday season and would not have the opportunity of getting into the field many times. Under this law quail have increased in all parts of the state. Each season there have been enough birds carried over for the next breeding season to produce an increased crop. An attempt was made at the last session to change to an earlier season, but fortunately it was frowned upon by the Assembly. Two deputies of the division during the morning of December 4th in western Fresno County checked 110 quail hunters. These hunters had 987 quail. Most of them probably secured limits after being checked.

OTHER GAME

Doves are holding their own under the September season in northern California and September and October in southern California. If doves nested only once during the summer the species could not survive very many open seasons as the normal clutch of eggs is only two. Fortunately, however, it seems that there may be as many as four broods raised by a single pair. The records show that doves nest in some part of the state practically every month of the year.

GROUSE

Grouse are represented in California by three species and an additional subspecies. In former years a fourth, the sharptail, was found in Modoc and Lassen counties, but there has not been a record of the sharptail being taken nor have any been seen for many years. The largest grouse, the sage hen, is still common in the sagebrush country in the higher elevations of the northeast part of the state and south into Inyo County. With the limited open season the drain has not been

particularly heavy and sage hen conditions are satisfactory. The sooty grouse is found in the pine country in practically all parts of the state north of the Tehachapi. It is nowhere abundant, probably two to four pair per mile would be the average abundance throughout its range. Grouse in general have been reduced. However, in some sections they have gained in number. The general reduction has not been from over shooting but probably on account of the destruction of the nests by sheep.

In the northwest coast counties is found the western representative of the eastern ruffed grouse. Unlike the sooty grouse that frequents the pine ridges the ruffed grouse is found only in the heavy timber and shaded dells along water courses. Its range extends south to Humboldt Bay and east into Trinity County and the western part of Siskiyou County.

PROTECTED GAME

Of the former great herds of elk that ranged in the interior valleys and in the upper country only a few hundred head remain. The California elk was a valley loving species, not extending its range to the High Sierra, reaching higher elevation only in the Coast range and then probably only when crossing from the San Joaquin to the Santa Clara and other coastal valleys. This species furnished much of the meat of the pioneer and was reduced to a mere handful in the 70's. A small herd which remained in the vicinity of Buttonwillow, Kern County, was given protection by Henry Miller, and is the remnant of the former great California herd. It now numbers about 400 head. From this herd from time to time a number have been moved to various parts of the state but while at first they have been welcome, they rather quickly wear out their welcome and there is a strong demand to have them removed.

There is a growing herd on the floor of the Yosemite Valley that will have to be moved to a more secluded area before many months. Those that were moved to Monterey County increased to such an extent that it was necessary to move part of them. A number were sent to western Yolo County but they have not thrived as well as in Monterey. Other plants have been made but with scarcely an exception they have not proved a welcome addition to the fauna of the region where liberated. Something must be done very soon with the Buttonwillow herd. With the cutting up of the land in that section there is no place for the animals to range. Cultivated crops are destroyed, cotton bolls are fed upon, just as dahlias were in Monterey. It is to be hoped that some day soon a tract of land can be secured where this species of elk, peculiar to California, may be perpetuated.

There are now three species of elk in California, for there still ranges in northwestern California at least 200 head of the Roosevelt elk that in early days extended from San Francisco Bay on the coast north into British Columbia. The plant of Jackson Hole elk that was secured by C. C. McCray of Redding and liberated in the region between the Pit and McCloud rivers has increased, it has been estimated, to nearly 200 head and now occupy a considerable area. Another herd of elk, probably the Jackson Hole variety, is now ranging in the Sierra west of Honey Lake. These were the elk that were held on the George Wingfield property near Susanville and liberated at the time he gave up the ranch. They number about twenty-five head.

ANTELOPE

There are at present several hundred head of antelope in the northwestern part of California. This species is receiving excellent protection and is increasing in number in that section. The Mt. Dome herd in Siskiyou County continues to increase and there is no reason to believe that any have been killed. The largest number, between two and three thousand head, are to be found in eastern Lassen County on game refuge 1-Q.

A small band is still to be found in western Fresno County but it is unlikely that they can very much longer withstand the advance of agriculture. Their range is now replaced by fields of potatoes, grain, cotton and other crops.

Probably nowhere in the west were antelope more abundant per square mile than they were forty or fifty years ago in the Antelope Valley country in the vicinity of Neenach, Los Angeles County. Mr. James Barns, who settled there forty years ago and still lives in the valley, says that he never saw so many antelope anywhere in his early travels as he did there. It was not uncommon to see many bunches of from two to three hundred head. This group has been practically exterminated. There is reason to believe that only ten are left.

MOUNTAIN SHEEP

Mountain sheep are yet to be found in the desert ranges from Imperial County north to Mono. Their numbers have been estimated into the thousands. This species, unlike most game animals, does not compete with agriculture. The region which it frequents is one that cannot be used by man. Under such conditions and with reasonable protection there is no danger of exterminating the species. The only sheep in northern California is a small band of six reported by Deputy Carl Fisher in eastern Lassen County.

RING-NECKED PHEASANTS

Ring-necked pheasants may now be found in almost every part of the state, where climatic and topographical conditions are suitable. It is not uncommon to have them cross the road in front of your automobile in many places. The birds are probably most abundant in the delta of the San Joaquin and Sacramento rivers. There are also hundreds in that section of Santa Clara County between Milpitas and Mountain View. In many other parts of the state they are scarcely less abundant.

GAME REFUGES

During the legislative session of 1927 over 500,000 acres were added to the game refuges of the state. Five new areas were set aside and certain of the refuges were enlarged that had been created at earlier sessions.

Refuge 1-N was set aside in the western part of Modoc County, extending slightly into Siskiyou. It is located in the heart of the big mule deer country and was created so as to give additional protection to that species. It is a very well marked refuge, being bounded by roads on all sides.

Refuge 1-O, an area of 68,500 acres, was set aside in El Dorado County. This area is also bounded by easily established lines. On

the south by the American River and the Tahoe state highway, on the east by the Georgetown Junction-Wilson-Blakely road and on the north by the north fork of Silver Creek and Silver Creek. The area included is well stocked with deer, quail and grouse.

Refuge 1-P, containing 55.700 acres, is bounded by well-known roads in the vicinity of Dixy Mountain in eastern Plumas County, and includes an excellent section well stocked with various species of game.

Refuge 1-Q is one of the largest and also one of the best of our California sanctuaries. It comprises an area of 300,000 acres in eastern Lassen County, is well bounded by roads, streams and ridges. On the east it borders on a similar refuge in the state of Nevada. Within the boundaries are represented more species of game than in any other refuge in the state. There are hundreds of antelope, mule deer, practically the only white-tailed deer in the state, a small band of mountain sheep, thousands of sage hens, and both valley and mountain quail. There is also some area within the refuge where waterfowl find congenial conditions and where ducks, geese jacksnipe, and other shore birds may be found nesting.

Refuge 3-G, comprising the property of Leland Stanford University in San Mateo and Santa Clara counties, was set aside so as to give the university authorities the opportunity of studying our fauna without interference from outside influence. Studies will be made of the effect of various conditions on the abundance of wild life that will be of great value to conservation work. The 8500 acres within the refuge is well stocked with the fauna of our California coast range.

Refuge 4-G is an area of approximately 20,000 acres near Mt. Jacinto in Riverside County. The western boundary is the crest of the San Jacinto range reaching over 10,000 feet. The eastern boundary is midway between the ridge and the floor of the valley near Salton Sea. The refuge can only be approached through two trails on the west. The one trail from the east is practically impassable. There are many southern mule deer within its boundaries and it is likely that there are a considerable number of mountain sheep.

REFUGE SURVEY

During the past year a survey has been made of the thirty-three game refuges in the state. The men on this work have not only been running and posting boundaries but have secured data regarding better boundaries and abundance and general condition of game in the refuges.

It is our intention to eliminate wherever possible boundaries by section and township lines and to use only boundaries that can be easily located—streams, ridges and roads. We now have set aside by legislative act more than 3700 square miles of game sanctuaries. In addition to this there is half as much more in national parks, in which hunting is prohibited, or a grand total of 5567 square miles, approximately 6 per cent of our game area, set aside for breeding ground. This is an area almost equal to the combined area of the states of Rhode Island and Connecticut.

It should not be overlooked that there are many hundreds of square miles of privately owned land upon which all hunting is prohibited and many more upon which there is restricted hunting. Everything considered, there is little need to fear that any of our native species are now in danger of extermination.

REPORT OF THE BUREAU OF COMMERCIAL FISHERIES

By N. B. Scofield, In Charge

Taken as a whole the commercial fisheries of California are in a healthy condition and have continued to grow during the past biennial period. The data of the fresh and other commercial fishery products are reported by calendar years instead of by fiscal years, for the reason that the calendar year better fits the fish seasons. For the years 1926 and 1927 the department has issued these data in the form of Circular No. 1 and Circular No. 2.

In the year 1926 the catch of all varieties of fish in state waters and off the coast of the state was 360,024,944 pounds. The catch of shellfish in these waters for the same year was 11,623,331 pounds, making a total of 371,648,275 pounds. In addition to this, California fisher-

Fig. 33. Noyo estuary, a center for salmon trolling operations along the north coast. Photograph by J. O. Snyder.

men caught off the coast of Lower California, in both territorial and extraterritorial waters, 22,320,570 pounds of fish which were brought into California, and from the same waters there were brought in 738,171 pounds of shellfish caught jointly by California and Mexican fishermen. The total amount of fresh fish and shellfish caught in the state and brought into the state during the year was 394,707,016 pounds. For the year 1927 the fish caught in the state and along our coast was 409,400,081 pounds, while the shellfish from the same waters brings the figure up to 424,367,182 pounds. The fresh fish and shellfish brought into the state from south of the international line add 62,132,490 pounds to the figure, making a grand total of 486,499,672 pounds. The commercial fish catch of 1927 exceeds that of any year in the history of our fisheries.

California's fisheries are remarkable for their size and for their diversity. In both of these counts California surpasses all other states.

Alaska surpasses our state only in the volume of its fish catch. From Circular No. 2 of the Division of Fish and Game, which is a statistical report on fresh and canned fishery products for the year 1927, we learn, besides the total volume of the state's commercial fish catch as given above, that the estimated value of the fish pack was $23,348,516. If we add to this the value of the fish going into the fresh fish markets, the total value of the state's fishery products is well over $25,000,000. We have 75 fish packing plants the value of which is over eight and one-half million dollars. In these plants are employed 6461 people. 3,882,900 cases of fish were canned in the year, seventeen kinds of fish and shellfish being used. At least twenty kinds of fish and shellfish were salted, dried or smoked. There were produced 21,111 tons of fish meal and 2,618,490 gallons of fish oil.

California is probably most remarkable for the diversity of her fisheries, both in methods of fishing and in the number of varieties of fish caught. The species of fish and shellfish of commercial importance in the state exceed sixty in number. This number is not even approached by any other state and it is our belief it far exceeds that of any other country. From the viewpoint of conservation there is a great advantage in having diversified fisheries such as California's for the reason that the species of fish compete with each other, either for food or by actually devouring each other. Under natural conditions there exists more or less of a balance between these species so that if man comes in and concentrates his fishing efforts on only a few of the species, the check is removed from the unutilized varieties with the result that they will prosper at the expense of the kinds which are being fished for. In other words, the fisheries will stand the strain of fishing better if the commercial catch is made up of many species, instead of a few. Another advantage our state derives from its diversified fisheries is the splendid assortment of fish and shellfish to be found in our markets at all seasons of the year. One of the things which makes a lasting impression on visitors to the state is the large number of sea food restaurants which serve such a variety of sea foods.

The sardine catch in the state continues to overshadow that of all other species combined. The combined catch of species other than sardines has remained fairly constant during the past thirteen years, while the catch of sardines has fluctuated greatly. If a graph is made it shows very clearly that the fluctuation in the catch of sardines follows what has been called the "prosperity curve." The catch of sardines increased greatly during the war, due to the great demand for canned fish. Then came the post-war slump beginning in 1920 and reaching its lowest level in 1921. Since that time the recovery has been rapid. The combined catch of all other species of fish has also followed this same prosperity curve, although the correlation is not so obvious as in the case of sardines.

We are justified in arguing from this that the catch of sardines, as well as the combined catch of the other species, is being determined by economic conditions and not by fluctuations in the abundance of the fish. We would be in error, however, if we argued that the actual abundance of the fish in the sea is following this prosperity curve. An increased catch is caused by an increased demand, usually coupled with an increased fishing effort. During the peaks of production more fish canneries are operating and more boats are fishing. If we are to know

what is happening to the fish population, we must take into account the fishing effort. Total catches, taken alone, are misleading. If the total catch of a species is on the decline, in spite of an increased demand and an increased effort to catch the fish, then we can be reasonably certain that the species is actually declining in numbers. The best measure of the abundance of any commercial species of fish is the average catch for a given unit of effort. This method is being followed by the bureau with those species for which there is any cause for worry. (See former biennial reports, more especially the reports of the Director of the State Fisheries Laboratory.)

In the fisheries conservation program which we are following, we are less interested in the study of conditions in the sea which may cause fluctuations in the abundance of the commercial species of fish than we are in what is actually happening in the fisheries themselves. We are primarily interested in the abundance of the species and in the intensity of the fishing effort as revealed by the statistics of the catch. If we do not find out what the fluctuations are in the abundance of the com-

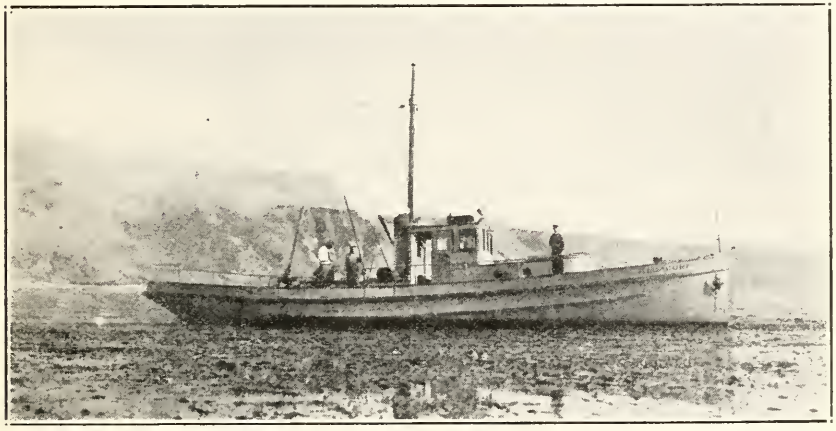


FIG. 34. Patrol boat *Albacore* searching for spiny lobster traps set in kelp beds during the closed season. Only a small block of wood floating at the surface marks the trap. Photograph by E. S. Cheney.

mercial species we have nothing to explain; and a study of life histories or of conditions in the sea will not aid us in our work of safeguarding the species from overexploitation.

SARDINES

The sardine catch in California for the calendar year 1926 was 286,741,250 pounds, and for the year 1927 342,275,289 pounds. These amounts are greater than for the preceding biennial period. The amount of sardines caught is more than three times the catch of all other species combined.

In our last biennial report we stated that a good market had developed for our sardines. The pack was being sold at a profit and it appeared that the good times the canners had been looking for were coming. During the season of 1926–27 sardines were plentiful and a larger pack was put up. The price for the canned fish remained very

good until a time in the spring when packing ordinarily stops, due to the soft and unsuitable condition of the fish. The temptation to continue packing while the price was good was too much for some of the packers to resist. The result was an overproduction and a slump in the market. In the sardine season of 1927-28 a still larger pack was produced and the price remained very low. Two and a half million cases of one-pound oval cans of sardines were put up, and the same practice of canning too late in the spring was continued. As a result, the next season was sure to open with a large carry-over, and the industry was in anything but a healthy condition. All the canners are in favor of establishing by law a closed season during the time sardines are not in prime condition for canning.

At different times the canners have attempted to organize so as to overcome some of the bad features of the sardine canning industry, but

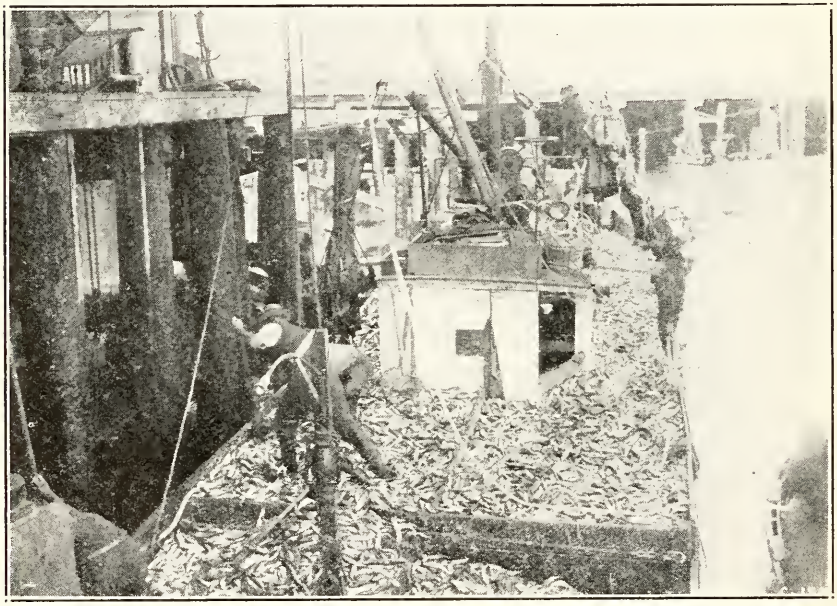


FIG. 35. Typical round haul boat unloading sardines at cannery in southern California. Photograph by E. S. Cheney, fall of 1928.

without any great success. As the economic situation was getting rather desperate during the season of 1927–28, a sardine export association was organized under the Webb-Pomerene Act, with nearly all of the canners who pack pound-oval sardines as members. B. D. Marx Greene was chosen secretary-manager of the organization. Mr. Greene's resignation as attorney of the Bureau of Commercial Fisheries became effective on March 1, 1928, and immediately thereafter he was retained by a group of the sardine canners to make a survey and submit plans for organization.

As a result, two organizations have been formed. One, the California Sardine Export Association, has to do only with the business of sardine export and is expected to help do away with the bad practices

which have arisen under "cutthroat" competition. The underlying object is to get a better price for their sardines. The second organization formed is known as the Sardine Canners Association of California, and has as members both tuna and sardine canners. The object of this organization is to improve the standard and quality of the pack, under a strict inspection which for a couple of years has been carried on under the supervision of the State Board of Health. It is expected to put the entire industry upon a more profitable basis and, incidentally, to form a closer cooperation with the Division of Fish and Game along law enforcement, legislative and constructive lines.

One of the first acts of the Sardine Canners Association of California was to ask the Division of Fish and Game, as a conservation measure, to prevent waste of fish, to establish a closed season on sardines until August 6th of this year, 1928. Such an order was issued by the Division and the order was strictly obeyed by the canners. As a result, there were no soft fish put up by too early an opening and, incidentally, the carry-over was materially reduced before the season opened.

Sardine inspection and fish cannery research.

In the year 1924 the sardine canners of southern California organized and financed an inspection service under the supervision of the State Board of Health. Some cases of sickness from eating sardines had been reported and the inspection was for the purpose of making sure that all of the packers were taking proper care in handling the fish and in sterilizing the cans a sufficient length of time in the retorts and under the proper pressure. Two years later the canners at Monterey came in under the inspection, and the southern California canners provided for the same inspection of their tuna canning operations. This inspection is well organized and is under a man furnished by the State Board of Health. He has inspectors at the separate canning centers who inspect the operations in the canneries. They see to it that all the health regulations as to sanitary requirements of the premises and employees are carried out and that all of the canned fish are properly sterilized. The retorts in which the sterilization is done are all equipped with automatic temperature and pressure gauges and a self-recording chart insures that each retort of fish has been cooked for a sufficient length of time and under the proper temperature and pressure.

After this inspection had been organized, it was realized that there was great need for research in connection with the canning of fish. Some preliminary work had been undertaken under Dr. Karl F. Meyer, of the University of California, but to warrant continuing the work Dr. Meyer told the canners sufficient funds should be provided to insure the continuance of the work for three years with a sufficient personnel and equipment. At the request of the canners, the Fish and Game Commission agreed to furnish the funds for this work. Beginning with the fiscal year of 1926-27, $15,000 was to be furnished each fiscal year for three years. This agreement was carried out and we are now entering our third fiscal year. Under the agreement, the money has been turned over to the Hooper Foundation for Medical Research of the University of California, and the work has gone on under the supervision of Dr. Meyer. Much work has been done which is of value to the fish canning industries of the state and results have already begun to appear in the form of publications.

Legislation.

Prior to the 1927 session of the legislature, a full meeting of the sardine canners of the state was held at Los Angeles. This meeting was attended by the Commissioners and executive officer of the Fish and Game Commission and by members of the Bureau of Commercial Fisheries. It was agreed at this meeting that the canners and the Commission would work together at the legislature to get the sardine reduction act amended. It was agreed that the bill was to be drawn up by the Fish and Game Commission and should provide that from each ton of sardines received the canners be required to produce fifteen cases of pound-oval sardines on the average of each calendar month, or preferably in each lunar month, and that in case a canner fell behind in one month he was to have an additional month in which to make up the

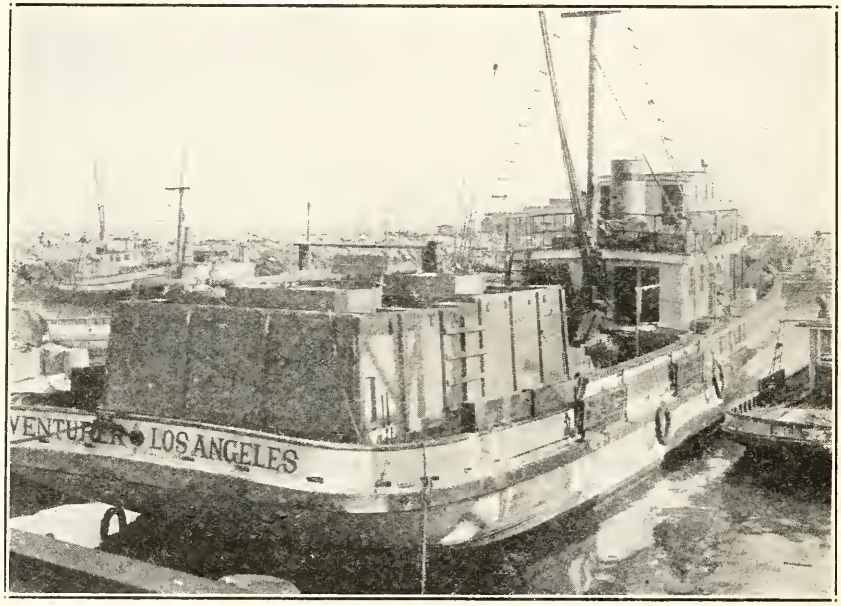


Fig. 36. New type of fishing boat used off Mexican coast. Several tons of live bait carried in tanks have given this type the name of "bait boat." Photograph by E. S. Cheney.

deficiency. The bill would have eliminated the special provision whereby sardines may be taken for the production of edible oil. A number of other minor measures were to be incorporated in the bill.

The canners' legislative committee was dissatisfied with the Commission's draft of the bill, and in our efforts to get together, it became finally evident that the part of the committee representing southern California was in favor of permitting sardines to be taken for manufacturing edible oil. They preferred to let the law stand as it was, they said. All efforts to get together failed, and as it became evident that the Senate Fish and Game Committee would not pass the bill out, it was finally withdrawn. We were therefore left with the same law, which was unsatisfactory and somewhat ambiguous due to the fact that an indefinite portion had been declared unconstitutional by the courts.

The canner was still entitled to use sardines in his reduction plant to the amount of 25 per cent of the cannery's capacity, but that part of the law which defined how this capacity should be determined had been declared unconstitutional, and a later decision left it doubtful if the Commission had the power to hold hearings or to determine the capacity of a cannery.

Further litigation.

When in December, 1925, the District Court of Appeal (in the case of *Van Camp Sea Food Co., Inc.*, vs. *Fish and Game Commission*) held that the Commission did not have the judicial powers conferred on it in the reduction act, the Commission was advised by its attorney that it followed that it did not have the power to hold hearings on the appli-

FIG. 37. Department of Commercial Fisheries patrol boat *Albacore* confiscating a net being illegally used in waters off the coast of southern California. Photograph by E. S. Cheney.

cations of companies to use a reduction process to manufacture edible products from sardines or to grant permits to such concerns.

In September, 1926, the Bayside Fish Flour Company, of Monterey, proceeded to operate and the Commission brought injunction proceedings in the Monterey County superior court, taking the position that the permit which had been given the company was null and void, as the Commission had no authority to issue it. Technicalities were waived and the matter speedily came up before Judge Fred A. Treat at Salinas. The decision in this case was for the Bayside Fish Flour Company, the judge's decision being to the effect that the Commission had the powers the legislature had conferred on it in the act. This decision was in conflict with the Los Angeles court which had held the Commission did not have these powers.

At about the same time the Globe Cotton Oil Mills, of Los Angeles, asked for a hearing on their application for permission to take sardines for the purpose of manufacturing edible oil. This the Commission refused and the company sought a writ of mandate in the Supreme Court to compel the Commission to hold the hearing. The Supreme Court decided in favor of the petitioner. The court's decision, in part, is as follows:

> "This court is of the view, however, that admitting that the Fish and Game Commission can not be granted any power which constitutionally belongs exclusively to the judicial department of the state government, the granting of power to hold hearings and determine facts incidental to the regulation of fish and game, and to the granting of permits to take and use fish, is valid as an administrative or regulatory power, and in no wise transgresses upon the judicial functions of the judicial department."

This was, in effect, a victory for the Commission. After this decision was rendered on January 20, 1927, the Commission notified the sardine canners that they must make application to have the capacities of their canneries determined by the Commission. Most of the southern California canners failed to make application. The Commission then sought to enjoin the Van Camp Sea Food Co., Inc., from using sardines in its reduction plant. The defendant filed a general demurrer. On November 14, 1927, Judge Stephens, of the Los Angeles County superior court overruled the demurrer, thus sustaining the Fish and Game Commission. This was really a reversal of the judge's earlier ruling, and was caused by the ruling of the Supreme Court in the Globe Cotton Oil Mills case quoted from above. The Commission then filed injunction proceedings against three other canners at San Pedro who were using sardines in their reduction plants without a permit from the Commission. The court issued orders temporarily restraining all of these companies from using any sardines in their reduction plants. All canners thereupon applied to the Commission for hearings and agreed to abide by the regulations of the Commission. The pending cases were therefore dismissed.

Floating reduction plants.

At the beginning of the sardine season of 1926-27, the Ocean Industries, Inc., had equipped the old concrete barge *Peralta* with reduction machinery, and anchored it five miles from shore within Monterey Bay and proceeded to take sardines from two purse seine boats, which were careful to catch their sardines more than three miles from the shore, although they were caught within the bay. The Commission arrested the two captains of the fishing boats and seized their nets, charging them with violating the Fish Exchange Act, which forbids the diversion of food fish for purposes other than human consumption without the written consent of the state market director. Injunction proceedings were brought against the company and a restraining order was issued by the superior court of Santa Cruz County. The defendant thereupon filed petition for an injunction in the United States District Court at San Francisco, claiming that the *Peralta* and their fishing boats were beyond the jurisdiction of the state. Their application for injunction was denied by Federal Judge A. F. St. Sure, who decided that all of Monterey Bay was within the State of California. On November 1, 1926,

Judge H. C. Lucas, of the superior court of Santa Cruz County, granted an order for an injunction *pendente lite*. The Ocean Industries, Inc., then applied to the Suppreme Court for a writ of prohibition. This was denied by the superior court on January 11, 1927, the court holding that Monterey Bay from headland to headland and three miles beyond was within the State of California. It also held that the *Peralta* was anchored within the county of Santa Cruz. The *Peralta* was later moved to southern California and anchored outside the three-mile limit in the Santa Barbara channel, but it did not receive any fish, for the company was unable to get any fishermen to fish for it. The company brought a new suit against the Commission in December, 1926, asking for an injunction to prevent the Commission from interfering with their operations beyond the three-mile limit. This suit was brought in the United States District Court for the Southern Division, and the court denied the application for temporary injunction.

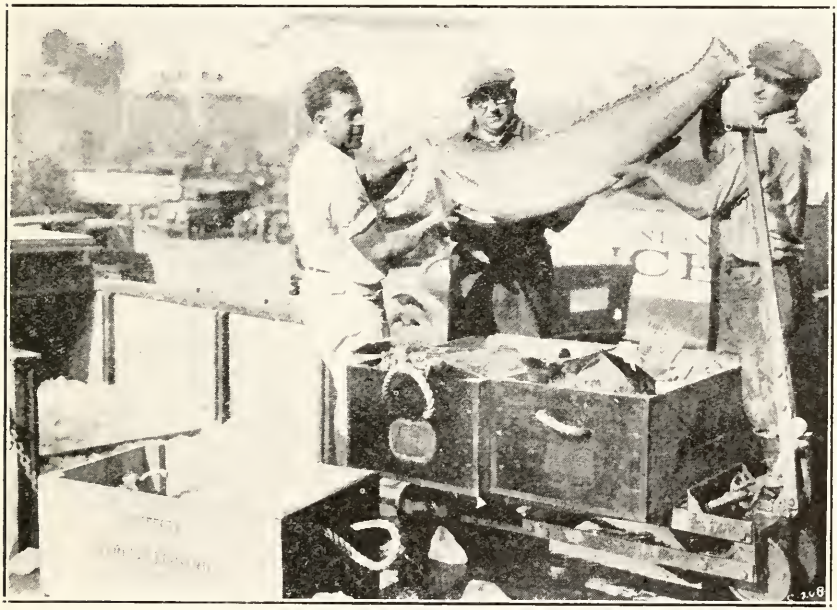


FIG. 38. Totuáva, or Mexican white sea bass, caught in the Gulf of California and hauled to San Pedro fish markets in ice by insulated trucks. Many tons of this fish are imported from Mexico. Photograph by E. S. Cheney.

Still another floating reduction plant, the *Lake Miraflores,* operated by Stanley Hiller, Inc., with motive power of its own, attempted to operate in southern California. The Commission started action against this company in the Alameda County superior court. The case was decided against the Commission on the ground that the *Lake Miraflores*, when operating, was not within the jurisdiction of the state.

A full discussion of all these cases, with references, is given in an article by B. D. Marx Greene in *California Fish and Game* for January, 1927, pages 1 to 17, and in *California Fish and Game* for January, 1928, pages 42 to 44, and entitled "An Historical Review of the Legal Aspects of the Use of Food Fish for Reduction Purposes."

From our experience with these two attempts of floating reduction plants to operate on sardines beyond the jurisdiction of the state, we are sure that such a plant can not be operated at a profit off the coast of this state because of the high overhead cost and the uncertainty of the sardine supply due to rough weather and the erratic appearance of these fish in the open ocean beyond the protection of bays.

SALMON

While our fisheries as a whole are in a healthy condition, it cannot be said that our oldest fishery, that of the salmon, shares this condition. The most important conservation problem having to do with fish or game in this state is that of saving what is left of the Sacramento salmon.

We have repeatedly called attention to the fact that the salmon of the Sacramento River are not being given sufficient protection and that this valuable natural resource of the state is fast being destroyed. The legislature has been told that if these salmon are not given more protection they will soon become commercially extinct. We have pointed out that the run on the river is only five per cent of what it was twenty years ago; that the hatcheries on the river can not obtain enough eggs with which to run them at even ten per cent of their capacity. At each session of the legislature for the past twelve years the Fish and Game Commission has sponsored bills which would have given these fish at least a measure of the protection needed, but in no instance was it possible to get more than a very small portion of the protection asked for.

At the last session the Commission was sponsor for a bill which would have eliminated sea trolling for salmon. It was pointed out that the salmon supply had been so diminished that to fish for them, in both the sea and the river, was fast destroying the supply, and to save the remnant that was left, one or the other method of fishing should be stopped. As the river fishing has more to commend it than the sea trolling, we proposed that trolling be stopped.

The measures embodied in this bill were endorsed by the Associated Sportsmen's Clubs and included a prohibition of all salmon spearing. For a number of years salmon spearing had been stopped in all but the extreme northern half of the state. When the several salmon bills came up for consideration before the Assembly Fish and Game Committee, this bill was not given a hearing and it had to give way to a bill sponsored by San Joaquin Valley sportsmen's clubs, member clubs of the state organization but whose only desire was to have the law changed so as to permit salmon spearing in their part of the state. Instead of advancing, we took a step backward. The committee consented to amendments for the purpose of confining spearing to a season when the salmon are in good condition to eat, and thus prevent the killing and discarding of fish which are not fit to eat although they may be of the greatest value for the purpose of reproducing the race. The committee also accepted amendments to prevent the spearing or killing of salmon on spawning beds, but it would not accept an amendment which, as a compromise, would have stopped sea trolling for salmon south of Mendocino County.

Due to the confusion caused by numerous changes in the bill as it progressed through the two houses and the two committees, in an effort

to get spearing and angling seasons to suit the various desires of sportsmen in the different parts of the state, a number of errors entered into the bill. As a whole, the salmon law is now quite unsatisfactory in that it does not suit the sportsmen anglers and does not give more than a small part of the protection from commercial fishing which is needed if we are to save the Sacramento salmon from commercial extinction. When this salmon bill came up before the Senate Fish and Game Committee, a very strong effort was made by Sacramento commercial fishermen to have the fall season extended to permit them to catch more fish, on the claim that the salmon are running later than a few years ago. The fishermen are honest in their conviction that the run on the river is getting later—but what appears to be a lagging of the run is not real but is due to serious depletion of the supply, during which the fish have become so scarce that it does not pay the fishermen to fish until a later time in the running season than formerly when the fish were more plentiful. This is a well-known phenomenon to fisheries investigators. (See page 116, "Is the Salmon Run Becoming Later on the Sacramento River?") The committee listened to our plea and refused to extend the season.

Commercial fishing on the Sacramento and San Joaquin rivers must not be entirely blamed for the present scarcity of salmon on these rivers. In the past years the fall season for commercial salmon fishing on these rivers has been extended at two or three different times to a later date on the claims of fishermen that the fish are running later. It was not recognized at the time that what appeared to be a gradual retarding of the run was the effect of serious overfishing. Four years ago we were able to get the closing date of the season put back from September 25 to September 17. That date is not early enough. It should be not later than September 7.

There are other causes which explain the growing scarcity of salmon on the Sacramento River. The chief cause is the building of power and irrigation dams which can not be surmounted by salmon. It is estimated that fully 75 per cent of the former area of suitable spawning beds have been shut off from the salmon. The silt from placer mining ruined most of the Sierra streams for salmon. Unscreened irrigation ditches have in the past taken a large toll from the young salmon migrating to the sea and this loss has not yet been entirely stopped. As the reproduction of the salmon was cut down by these factors the commercial catch on the river should have been cut down in proportion. But it was not. Then later the sea trolling for salmon grew to be important, being first developed at Monterey and later outside San Francisco harbor. The troll catch of some years exceeded five million pounds on Monterey Bay and that, coupled with the catch off San Francisco, equaled, roughly, the catch on the Sacramento River. Due to this large troll catch, which was largely made up of Sacramento salmon, the total catch on the river was greatly reduced. If this great added drain on the Sacramento salmon supply by troll fishing was to be permitted, the fishing seasons on the river should have been cut so as to compensate for it, but this was not done—just as in the same way nothing much had been done in the way of curtailing the river catch to compensate for the damage done by dams, placer mining and screenless irrigation ditches.

The troll catch in Monterey Bay is now only about ten per cent of what it was a few years ago. The number of salmon escaping the nets and reaching the spawning grounds, as evidenced by the number of eggs the Sacramento spawn-taking stations are able to take, is only five per cent of what it was twenty years ago. The total catch of salmon, including the Sacramento River and the troll catch in the sea from Monterey to Mendocino, is less than one-third of what it was ten years ago. All of this is sufficient evidence to convince the most skeptical that we have only a remnant of our former salmon supply left, and that nothing short of drastic measures will save the small remnant that remains.

FIG 39. Mackerel arriving at cannery in southern California. Photograph by E. S. Cheney.

KLAMATH RIVER SALMON

It is being claimed, by sportsmen mainly, that the salmon run in the Klamath is being destroyed by the commercial salmon fishery on that river. There is also complaint from the same source that the steelhead run is being destroyed by the nets and it is proposed to close the river to commercial fishing. I do not wholly agree with these charges, nor do I agree that the river should be closed to commercial fishing. As the conditions on the river, in relation to the commercial fishing, are so generally misunderstood, I propose to review briefly the recent history of the fishery on that river.

Prior to 1913 the salmon seasons for the Klamath were the seasons adopted for the Sacramento and did not fit and were not enforced. It was lawful to net steelheads on all of our northern streams, as is still the law on most of the streams of Oregon and Washington. In 1913 the present fall salmon season was adopted and the commercial fishing was confined to a tidewater district extending up the river about six miles.

A short open season was also provided during part of the time the spring run of salmon was on; and a few years later, during the war, a season from September 30 to November 1 was opened to permit the taking of silver salmon which enter the river later than the king run.

In 1913 there were three salmon canneries on the river. A year or so later the number was reduced to one and that has been the only cannery on the river since, unless we count the two or three small, portable canneries termed "sportsmen's canneries" because they can salmon and steelheads which the sportsmen catch. Under the law of 1913 the king salmon run on the river increased, as was evidence by the increased commercial catch coupled with an increasing egg yield at the Klamathon station many miles up the river, where the eggs were taken from salmon which escaped the nets or passed up during the closed seasons. The fall king season closed on September 6, and it was believed that a sufficient portion of the run entered the river after that date to spawn and maintain the supply, even if all the salmon entering the river during the open season should be caught. This belief was later justified by the decided increase in the number of salmon in the river.

At this time there was no sea trolling for salmon in that part of the state to act as an added drain on the river's salmon supply. The highways were yet so poor that it was not profitable for the San Francisco fresh fish markets to draw on the river's supply of fish. Under these conditions the fish supply of the river was actually being built up. Later came the development of a salmon troll fishery out of Eureka, whose field of operation gradually extended to the north until the Klamath's salmon were being caught in large numbers off the mouth of the river. The improved roads have not only opened the river up to sportsmen and subjected it to heavy fishing, but they have made it possible for fresh fish markets to send buyers to the river and to truck out the salmon and steelheads. The scarcity of salmon in California, due to the failing runs at Monterey and on the Sacramento, has added to the zest with which they are sought in the Klamath and in the sea outside the mouth. The king run in the river has begun to show signs of depletion. I am convinced that sea trolling is the principal cause of this depletion and that the salmon in the river would have held their own if it had not been for the development of the sea trolling off the mouth of the river.

A number of conservation measures have been passed by the legislature for the regulation of commercial fishing on the river. About six years ago the spring salmon open season on the river was done away with. Four years ago the late silver salmon season was taken out of the law, and it was made unlawful to take steelheads in nets or to sell steelheads which have been taken any place in California. At the same time, to prevent steelheads from being taken by the gill nets being used on the lower Klamath River for salmon, the minimum size of the mesh which may be used in the gill nets was raised from $6\frac{1}{2}$ to $7\frac{1}{2}$ inches. As the steelheads running between July 1 and September 6, the present netting season, are small, very few if any will be taken by the $7\frac{1}{2}$-inch gill nets. These measures which have been adopted should allay any fear sportsmen may have had that the steelhead run on the river will be damaged. There is no need to stop commercial fishing on the river as far as steelheads are concerned. As for the salmon, they will get

about all the protection they need from the action of the last legislature which cut off two months of the troll fishing by providing a closed season extending to the first of June. I am referring here only to the Klamath River and to trolling in the northern coast districts of the state and do not wish to imply that the salmon are getting necessary protection in the rest of the state, for they are not.

It has been here stated that only five per cent as many salmon eggs can be taken now on the Sacramento for the hatcheries as was taken twenty years ago. There has been no such falling off in the number of eggs which are taken on the Klamath. For a number of years an average of at least seven million young salmon a year have been planted in the Sacramento which were hatched from eggs taken from the Klamath.

IS THE SALMON RUN BECOMING LATER ON THE SACRAMENTO RIVER?

It is generally believed by fishermen that the salmon run on the Sacramento River is becoming later and that for that reason the open commercial season for netting should be extended to a later date. They believe that when the season now closes on September 17, the run is just getting good or that the best part of the run has not yet arrived. The run does have the appearance of becoming later, but in fact it is not later. The appearance of being later is due to the serious depletion of the river's salmon population, as I will attempt to show.

This appearance of a retarded run is a phenomenon which is not peculiar to the Sacramento River alone. It has been observed on other salmon streams in this country and on some of the salmon streams of Scotland. There may be two runs of salmon on a stream, as on the Sacramento, a summer and a fall run. These two runs are made up of the same salmon species. The summer run is always the smaller and is made up of individuals which come in earlier than the main run. On a stream with two runs, the fishing is poorest during the summer run because there are fewer fish in the river then. This summer run may be so light that it does not pay the commercial fishermen to fish. As the supply of salmon in the stream is depleted, the summer run is the first to be reduced to a point where fishing does not pay. It is a well known fact that this summer run is the first to show the effects of overfishing. Salmon streams in Scotland are called "early rivers" and "late rivers," the early rivers being those with spring and fall runs, the late rivers those without the spring run. W. L. Calderwood, the Scottish authority on salmon, has this to say about the effects of overfishing:

> After speaking of the reappearance of spring fish in a stream which has been given protection against pollution and overfishing, he proceeds:
>
> "In other cases where serious overfishing has been allowed to continue, rivers have naturally acquired a late character. With overfishing, or other causes of reduction of breeding stock, the first class of fish to disappear is the spring run."

Overfishing, pollution of the stream by factory waste or destruction of spawning beds by the erection of impossible dams affect both the early and late runs, but the early run, being the smaller, is the first to

reach the low point where it does not pay to fish. As this summer run begins to fail, some of the fishermen do not fish until the later fall season, and the belief arises that the salmon run later.

We have this same appearance of the run becoming later in the fall run itself. The runs do not come into the rivers suddenly. A run starts by a few fish arriving, and the run gradually grows in proportions over a period of several weeks or months until the peak is reached. After the peak is reached, the run quickly subsides and is soon over. For this reason, when serious overfishing is taking place, the peak and conclusion of the reduced run will remain fairly constant in time, but the time at which profitable fishing begins during the early stages of the run comes later and later, as the salmon supply is reduced. This is exactly what is happening on the Sacramento River. The run is not later. The profitable fishing is later but the conclusion of the run is not later.

A number of years ago the Sacramento season closed on September 16. The Fish and Game Commission and the legislature were convinced by the fishermen that the salmon run was growing later and that too large a portion of the run was protected by the closed seasons. Therefore, the open time was extended five days and a few years later again extended to September 25. It was then observed that before September 25 arrived, all the salmon had arrived and the last stragglers, or so many of them as were not caught by the nets, were well up the river. The fishermen on the lower salmon fishing grounds found that there were no salmon to catch as the run was over. Therefore, before the season closed, they would move up the river with their nets and the last remnant of the run was subjected to the intensive fishing of the combined commercial forces of the bay and the river. The closed season, theoretically designed to let at least one-third of the run pass up the river unhindered by nets, was not freeing any portion of the run from the destruction of the nets.

It took years of effort to get that closing time back to where it was. In fact it never has been gotten back to where it was. It closes one day later, on September 17. The season should close one week earlier than it does now, if we are to continue to have a Sacramento commercial salmon fishery. The fishermen are seeking to have the season close again at a later date. The object, of course, is so they can take more salmon. They still use the argument that the run has become later. I hope I have made it clear that where it appears the run is later, that is due to the serious depletion of the salmon supply. What we need is enough protection for our salmon that the run will have the appearance of becoming earlier.

REPORT OF THE CALIFORNIA STATE FISHERIES LABORATORY

By W. L. Scofield, Acting Director

INTRODUCTORY

The Bureau of Commercial Fisheries of the Division of Fish and Game carries on research work in connection with the administration of the fisheries of the state. This is not primarily for the purpose of furthering fisheries science but the research work was initiated because of the need felt for dependable basic information. It has been continued and enlarged upon for reasons given later in this report.

The first scientific inquiry was assigned piecemeal to various faculty members and students at universities in the state. It was found that many questions calling for investigation were intimately administrative problems. Also, the important research problems, whose solution was needed by the administrator, were found to require continuous inquiry over a term of years. Furthermore, the work was found to involve state records and for these reasons it was considered necessary that the state department should undertake the solution of such problems as could not be handled by others. The California State Fisheries Laboratory was therefore established for specific purposes, as an aid in the management of the state's commercial fisheries resources.

Several fisheries research problems are still being conducted independently of the state laboratory but under the personal direction of the head of the Bureau of Commercial Fisheries. For example, the life history studies of salmon, trout, striped bass and the census of our seals and sea lions. Most of the work concerning the more typically pelagic species is conducted at the California State Fisheries Laboratory. This report will confine itself to the research activities of the laboratory.

POLICY

The Division of Fish and Game, established originally as a "Fish Commission," has always been committed to the policy of true conservation of our natural resources, that is, using rather than hording, but using wisely. Wise use is plain business sense applied to conservation and means the fullest use possible up to the point where the resource becomes overused and so depleted that future use is thereby lessened. Full utilization gives the greatest possible benefit to the people of the state from each resource but overutilization for even a short period results in decreasing the use that may be made of the resource.

This common sense policy of wise use has nowhere been more earnestly followed than in the Bureau of Commercial Fisheries. In order that a resource be used wisely it is necessary that the administrator should know the extent of the resource, the rate at which it is being utilized and especially should he determine the point where overuse begins. It was for this reason that the Bureau of Commercial Fisheries established the research branch, known as the California State Fisheries Laboratory, and charged it with the task of supplying essential information as to the rate of use being made of our fish-

eries resources in order that the presence or absence of overuse might be determined. True conservation of a resource is impossible when such essential information is lacking.

It is, therefore, the policy of the research branch to contribute to the bureau the necessary information as to the fullest possible use of each fishery and to determine the point at which overuse begins to show itself. Proper knowledge of the resource is also necessary in order that an efficient, rather than a useless, remedy may be applied when it is found that any fishery is being overutilized. The first essential, however, is to know the facts in each fishery and to determine the point of fullest possible utilization short of depletion.

PROGRAM

The entire field of fisheries research was carefully canvassed before deciding upon the type of work to be carried on by the research branch of the Bureau of Commercial Fisheries. Since the chief object was to supply the administrators of the resource with needed information, many lines of work that commonly occupy the attention of fisheries research workers were set aside or indefinitely postponed. Studies of the complex conditions in the sea and general contributions to scientific knowledge of fishes were considered as best handled by the existing marine stations of the Pacific coast. Many specific questions as to the migrations, food or behavior of certain fishes were deferred until after more pressingly important information has been supplied to the administrators of the bureau.

Knowledge of the extent, utilization and condition of our fisheries resources was extremely scanty, so the most pressing problem was first to gather detailed data showing exactly the utilization in each fishery. In order to supply this basic information a complete system of fishery statistics was installed.

Since methods of study were not perfected it was necessary to determine what procedure gave most promise of showing us the first signs of depletion so that we might recognize indications of overutilization should they appear in any fishery. Two methods of study to show depletion were adopted and put into operation. These studies of the present supply of fish and the detection of overutilization are given first consideration on the program of the research branch of the bureau.

The program thus far outlined neglects a host of questions about fishes that are usually considered important and have frequently monopolized the attention of fishery workers in the past. It is frequently true that the success of a legislative act applied to a fishery depends upon some piece of information in the life history of the particular fish in question. It is desirable and sometimes necessary to know the feeding habits, time and place of spawning, characteristics of eggs and young stages, migrations and how the fish is affected by currents, temperatures, distribution of food or is influenced by other fishes and natural enemies.

It has been our endeavor to view this host of questions from a legislative standpoint and to select therefrom only such questions as give promise of bearing directly upon possible protective legislation in the future. This involves an examination of the existing legislation of each fishery to estimate its effectiveness. It would be impossible for us

to study all the questions in this comparatively unknown field of the life history and behavior of fishes, so we attempt to confine our inquiry to such questions as appear to be necessary in formulating legislation to apply in each fishery.

Of equal importance is the accumulation of information desirable in heading off unnecessary or unwise legislation and the acquiring of such knowledge as will be a benefit to the fisheries industries or will aid in the fuller utilization of a neglected resource.

The program briefly summarized gives first consideration to questions of existing supply of fishes and the detection of the first signs of depletion in each fishery in the endeavor to distinguish between full use and overutilization. In addition, problems in the life history and behavior of fishes are studied when knowledge of such questions appears to have a direct bearing on existing or proposed legislation. Along with such problems information is gathered for the purpose of benefiting the existing industries and encouraging full utilization of our fisheries resources.

TWO METHODS FOR STUDIES OF DEPLETION

The most important question about any fishery is whether or not it is being depleted. From the viewpoint of the people of the state all other questions are secondary. For this reason the major part of the research program of the California State Fisheries Laboratory is a study of the existing supply of fishes and the possible depletion of that supply. Two methods of studying the supply are now being used. One method is to follow, through a series of years, the average catch of fish resulting from a given unit of fishing effort since a dropping off in the returns for a given amount of fishing effort would show that the available supply of fish was becoming less.

The other method is to examine from year to year possible changes in the proportion of age classes of fish in the commercial catch because a decrease in the proportion of older fish would indicate a depletion of the fish supply. This involves a study of samples taken from the commercial catch at regular intervals over a period of several years and although a laborious process, it gives more complete knowledge of the changes taking place in our fish supply.

The first method is usually referred to as an analysis of boat catches since the catch of a boat for one day is a convenient unit of fishing effort. The daily catches of a certain group of boats are then followed from year to year to determine whether or not their average daily catches are being maintained.

RECORDS OF THE CATCH OF FISH

Records of the catch of fish, showing the amounts landed are a necessity to the administration of the fisheries as well as forming the basis for a study of possible changes in supply. It is a fact, frequently overlooked, that we have available detailed catch records for the past twelve years which show the monthly catches by species for each region. Such information is continuously called upon in the routine administration of commercial fisheries and whenever existing or proposed legislation is being considered. From these records much more detailed information may be compiled as required, such as the amounts of fish handled by any one dealer, prices paid, the deliveries by any

one fishing boat or the daily catch of any species at any fishing port. These records showing the daily catch of individual fishing boats form the basis for our analysis of boat catches and yield and desired information as to changes in the fish supply. As a necessary supplement to the catch records there is also recorded information as to the fishermen employed, dealers engaged in the fish business, number, kind and value of boats operating and descriptions of the kind and amount of fishing gear used. Work with these records of catch and gear forms an essential part of the program of the California State Fisheries Laboratory.

As our catch records are made out in the form of receipts, as required by law, from fish buyers and cannery men, there are many minor difficulties in the way of gaining complete and accurate data. Omissions of desired detail and confusion as to the common names of fishes are examples of such difficulties but of more importance are the adjustments necessitated by the changing and evolving conditions in our fisheries of this state. The last two years have shown a greater improvement in the dependability and completeness of these records than any other biennium since our system of catch statistics was established. There has been an even greater perfecting in the methods of recording, tabulating and proper filing of these data. Analyzing the more outstanding features from the catch records and the publication in graphic form of these results are now under way so that the salient features of these important records will be made more available to the fisheries industries, legislators and the interested public.

MOST IMPORTANT FISHERIES

Since our commercial fisheries resources are so great and so varied, it is out of the question for us to apply detailed study to more than a very few of the many problems calling for attention. Only some half dozen of the most important fisheries have so far been chosen for extensive investigation although several in addition have been given systematic observation and study.

By all odds the most important fishery of the state at present and for many years in the future is that of sardines. This fishery, because of its outstanding importance and the difficult administrative and legislative problems involved, has been selected as the major problem for investigative work. The albacore catch for several years ranked second to sardines in pounds landed, and this fishery called for a particularly detailed study. Other work of major importance has been done in connection with the barracuda and striped bass fisheries. As mentioned previously, the work of Dr. J. O. Snyder on the salmon fishery of California is not included in the work of the California State Fisheries Laboratory.

Special studies have been made of several fisheries considered minor as compared with the sardine and tuna fisheries. Examples of such studies are the investigations of the rock-fishes, smelt, Pismo clam, spiny lobster and grunion catches. One such special study is an investigation of the drag or paranzella net fisheries of the state, particularly as to the methods of fishing and to determine whether or not such fishing is destructive to young fish.

PUBLICATIONS

During the past biennial period two Fish Bulletins have been sent to press. Four other bulletins are nearing completion and are expected to be issued early in 1929. One of these deals with the monthly catch figures for each species and region of the state. The catch records are presented in graph form and the brief text is nontechnical. A second bulletin, by W. C. Herrington, presents the recent work on Pismo clams. Another bulletin is reporting the work of J. A. Craig on an analysis of the daily boat catches of striped bass over a period of eight years. Dr. Frances Clark is reporting work done on the smelt fishery of southern California.

In addition, eight other bulletins are partially completed. One of the most important of these is an analysis of the boat catches of albacore over a period of years. E. C. Scofield is reporting his work on the life history and behavior of the striped bass.

PERSONNEL

The greatest obstacle to carrying on the program of the laboratory is the lack of experienced workers. Partially trained men are available for conducting our routine work but they are incapable of handling the more advanced investigations. Our experienced men are attracted elsewhere by larger salary or greater opportunity for holding positions of responsibility and this is particularly unfortunate as these are the very men we need most. The remedy is for California to offer sufficient salary and opportunity for advancement to hold experienced research men.

REPORT OF THE LEGAL DEPARTMENT

By Eugene D. Bennett, In Charge

On the last day of December, 1927, Mr. B. D. Marx Greene resigned as executive officer and attorney for the Division of Fish and Game. Thereafter the legal work of the division was taken over by Mr. Eugene D. Bennett with the assistance of Mr. Ralph W. Scott and carried on at the office of the division in San Francisco.

The legal activities of the division are quite extensive and may be summarized in the following manner:

I

Prosecution of civil actions in the superior courts to enjoin public nuisances such as pollution of public waters, the maintenance of dams without fish ladders, diversion of waters without fish screens and other actions involving the preservation of fish and game. These actions are instituted in conjunction with the office of the Attorney General and in the name of the People of the State of California. The attorneys for the division appear as attorneys of record in these cases and handle all matters appertaining thereto.

II

Defense of all actions instituted in the superior court or in any of the higher or inferior courts against the division, the Commission, or any employees thereof in their official capacities.

III

Prosecution of criminal cases in the justice or police courts involving violations of fish and game laws, when requested to do so by the various district attorneys. Usually the deputy fish and game commissioners prosecute their own cases. But where a jury has been demanded or where the facts surrounding a case present some unusual feature, technical question, or local angle, the attorneys for the division appear. Fourteen of these cases were prosecuted by the division during the biennium.

IV

Rendition of opinions formal and informal for sportsmen throughout the state and those identified commercially with fish and game, such as fish packers, game farmers, propagators of domestic trout and the like. The attorneys for the division are constanly called upon to interpret the various fish and game laws for the public generally and for the employees of the division, particularly the men in the field.

The following is a résumé of the cases handled by the legal department during this biennium.

SUPREME COURT

Globe Cotton Oil Mills vs. *Zellerbach et al.*, 200 Cal. 276. This action was instituted by the filing of a petition for writ of mandate to compel the Division of Fish and Game to hold a hearing under the provisions of what is commonly known as the Fish Reduction Act (Statutes 1925, page 595), to determine whether a permit should be issued to petitioner to use sardines in the manufacture of edible oil. The division refused to hold the hearing, basing its refusal upon the language of a decision

of Judge Stephens of Los Angeles which seemed to deprive the Commission of all quasi-judicial powers, including that of holding hearings. The Supreme Court, however, decided in favor of petitioner. While a technical defeat for the division, it was, in reality, a victory because it restored to the division the right to hold hearings and pass quasi-judicially on matters intrusted to it by the legislature.

Ocean Industries, Inc., vs. *Superior Court, etc.*, 200 Cal. 235. This was a petition to the Supreme Court by the Ocean Industries, Inc., for a writ of prohibition to prevent the superior court in and for the county of Santa Cruz and Hon. H. C. Lucas, judge thereof, from proceeding further in a case entitled *People of the State of California* vs. *Ocean Industries, Inc.* In the latter case the division sought to enjoin the operations of the defendant on the steamer *Peralta* which had been anchored in Monterey Bay more than three miles offshore but within the confines of the bay. That concern had started to reduce fish in a manner contrary to the provisions of the Fish Reduction Act above referred to. To this petition the division filed a demurrer. The petition for the writ was denied. In a lengthy opinion the court upheld the jurisdiction of the state over the waters of Monterey Bay.

In re Makings, 73 Cal. Dec. 260. This was an application for a writ of *habeas corpus* directed to the constable at Sausalito to secure the release of petitioner from custody. He was being held on charge of transferring crabs from fish and game district 1½ to Sausalito. This case attacked the constitutionality of that portion of section 628 of the Penal Code commonly known as the Humboldt crab law. Petitioner claimed that that portion of the act which prohibited him from exporting crabs from Humboldt County was unconstitutional. On May 17, 1926, the District Court of Appeal upheld the law and denied the writ. Thereafter the petitioner brought the case before the Supreme Court, which affirmed the decision of the District Court of Appeal and sustained the contention of the division.

Zuanich vs. *Zellerbach et al.* This was a petition sought out in the Supreme Court for a writ of supersedeas to prevent the Fish and Game Commission from enforcing a judgment rendered in the superior court of Santa Cruz County condemning certain fish nets used in conjunction with the operations of Ocean Industries, Inc. To this petition the Commission demurred. Before the matter was submitted, it was settled out of court and the appeal was thereupon dismissed.

Andrew Zamberlin vs. *Zellerbach et al.* Same as previous case.

UNITED STATES DISTRICT COURT

Ocean Industries, Inc., vs. *Zellerbach et al.* This was a proceeding for injunction instituted by the Ocean Industries, Inc., combined with an action to recover damages from the Fish and Game Commissioners and several of the division employees. The suit was a result of steps taken by the division and its employees to prevent the operations of the Ocean Industries, Inc., in Monterey Bay on board the stamer *Peralta*. Extent of jurisdiction of the State of California over the waters of Monterey Bay was the legal question involved. The division demurred to the complaint and after oral argument an opinion was handed down by District Judge St. Sure upholding the contention of the division

and denying injunction relief and damages. The court in this case held that the waters of Monterey Bay are territorial waters, irrespective of the three-mile zone.

SUPERIOR COURT

People vs. *Italian Food Products Co.* This was an action commenced in the superior court of Los Angeles County to prevent the defendant from using fish for reduction purposes. This action was brought on the theory of the division that, in the light of the ruling in *Van Camp Sea Food Co., Inc.*, vs. *Fish and Game Commission*, 49 Cal. App. Dec. 38, packers were not entitled to any allowance for reduction purposes whatsoever, inasmuch as the method of determining the capacity of their plants as provided in the Fish Reduction Act had been declared unconstitutional. The case came on for hearing before Judge Stephens of Los Angeles on a demurrer filed by the defendants. In a lengthy opinion the court held that every packer was entitled to an allowance for reduction purposes of 25 per cent of the capacity of the plant but that the Fish and Game Commission was without judicial power to determine such capacity. This case was decided August 9, 1926.

People vs. *Marine Products Company.* Same as previous case.

People vs. *Van Camp.* Same as previous case.

People vs. *Franco Italian Packing Co.* Same as previous case.

People vs. *Anderson-Cottonwood Irrigation District.* This was a suit for injunction filed in the superior court at Redding to prevent the defendant from maintaining its dam in the Sacramento River until such time as it complied with an order of the Fish and Game Commission to install a fish ladder. The matter was settled out of court when the defendant agreed and proceeded to install. In consequence thereof the action was dismissed.

People vs. *Battaglia et al.* This was an appeal to the superior court of Marin County from a judgment of the justice court at Sausalito. The defendant had been convicted for illegal use of nets. After oral arguments the judgment of the lower court was upheld and the appeal dismissed.

Lowe vs. *Carpenter et al.* This is an action commenced by the owner of 270 live geese for an injunction to prevent the seizure thereof by deputies of the Fish and Game Commission. The geese are used as decoys. The case is still pending.

People vs. *Bayside Fish Flour Company.* This was an action commenced by the division to enjoin the defendant from taking fish into its plant and there manufacturing it into an edible product. This case was brought to test out the point raised by the division that the granting of a permit to manufacture such a product would be a judicial act on the part of the division, in view of the decision of Judge Stephens of Los Angeles in *People* vs. *Italian Food Products Co.*, and would be void *ab initio*. On November 24, 1926, Judge Treat of Salinas decided in favor of the defendant, holding that the division had power to grant such a permit.

People vs. *Ocean Industries, Inc.* This was an action commenced in the County of Santa Cruz to restrain the operations of the defendant aboard its steamer *Peralta,* heretofore referred to. Injunction *pendente lite* was granted but thereafter the defendant company retired from business, ceased its operations, and removed its steamer.

People vs. *Marine Corporation et al.* This is a petition to the superior court of Los Angeles for injunctive relief against various defendants for causing oil to be deposited into the Pacific Ocean at Long Beach. Action is still pending.

Stanley Hiller, Inc., vs. *Zellerbach et al.* This was a petition for injunction commenced in the superior court of Alameda County to prevent the Division of Fish and Game and its representatives from interfering in any way with the proposed operations of petitioner. The company intended to send a steamer to sea known as the *Lake Miraflores* equipped to operate as a fish reduction plant. Judgment was rendered for the defendant Commission.

People vs. *Stanley Hiller, Inc.* This was a suit brought in the superior court of Alameda County for injunction to prevent operations of the defendant aboard the steamer *Lake Miraflores* off San Pedro. At that time the *Lake Miraflores* had anchored more than three miles from shore. It was contended by the division that the ship was in the confines of San Pedro Bay and consequently in territorial waters. The judge held, however, that the steamer was not within the limits of San Pedro Bay but was, at the time of the operations, on the high seas. This case was decided March 7, 1927.

Petrich vs. *Maddox et al.* This was an action instituted in San Diego County to recover damages from certain employees of the division who had arrested the plaintiff and taken a quantity of fish from him for violating the law. This case went to trial and was decided in favor of the defendants.

People vs. *Glenn-Colusa Irrigation District.* This is an action instituted by the division in the superior court of Glenn County to enjoin the defendant district from diverting water from the Sacramento River into its irrigating ditches until such time as it installs a fish screen at the intake thereof in accordance with the order of the division. Action is still pending.

Sturtevant vs. *Greene et al.* This was an action commenced in the superior court of Marin County to recover damages from a group of employees of the division. It was based on the ground that a quantity of fish had been taken unlawfully from the plaintiff by defendants. Judgment was rendered for the defendants on October 20, 1927.

People vs. *Central Mendocino Power Co.* This is an action instituted by the division in Mendocino County to enjoin the defendant power company from maintaining a dam in James Creek until such time as it installs a fish ladder therein in accordance with an order of the division. Judgment rendered in favor of the defendant on March 5, 1928. Notice of appeal has been filed by the division. The case is still pending.

People vs. *Associated Oil Company.* This is an action commenced in Los Angeles County to enjoin seventy oil operators at Huntington Beach from polluting the waters of the Pacific Ocean with petroleum. The action is pending.

People vs. *Gardella.* This was an action commenced in the superior court at San Francisco to enjoin the defendant, a resident of that city, from maintaining a dam in Trinity County without first having installed a ladder in accordance with an order of the division. Judgment was rendered for the people on December 1, 1927.

People vs. *Sea Coast Packing Corp.* This was a suit started in the superior court of Los Angeles County to restrain the defendant from operating its plant without first having had the capacity of said plant determined by the division in accordance with the terms of the Fish Reduction Act. This action was based on the decision of the Supreme Court in *Globe Cotton Oil Mills* vs. *Zellerbach*, hereinabove cited, which gave the division the right to quasi-judicially make determinations of fact and hold hearings. This case was heard before Judge Stephens of Los Angeles, who practically overruled his former decision in *People* vs. *Italian Food Products Co.*, heretofore quoted. Whereupon the defendant made application to have its capacity determined and in view thereof the case was dismissed.

People vs. *Southern Fish Corporation.* Same as previous case.

People vs. *Kittle-Joerissen Canning Co.* Same as previous case.

People vs. *Van Camp Sea Food Company, Inc.* Same as previous case.

People vs. *Submarine Oil Company et al.* This is an action to restrain four oil producers from polluting the waters of the Pacific Ocean at Summerland with petroleum. The case is still pending.

People vs. Lomita Gasoline Co. et al. This is an action to restrain six oil companies from polluting the waters of the Pacific Ocean at Long Beach with petroleum. The matter is still pending.

People vs. *Gibson et al.* This is an action commenced in the superior court of Trinity County to enjoin the defendants from maintaining a dam until such time as they install a fish ladder as required by law. Action is still pending.

People vs. *Enos et al.* This is a suit instituted in Trinity County similar to the previous case.

People vs. *Kittle-Joerissen Canning Company, Inc.* This is an action commenced in the county of Sacramento to recover delinquent taxes for the privilege of taking fish as provided by chapter 687, Statutes 1917. Action is still pending.

People vs. *L. A. Sea Food Products Co.* Same as previous case.

CONDEMNATION OF NETS

It is the duty of the division under section 636*a* of the Penal Code to instigate proceedings to condemn all nets seized in violation of fish laws. These actions are brought in the superior courts. In compliance with this section the Commission started one hundred sixteen separate proceedings. In each instance it obtained a judgment of condemnation.

HEARINGS

In accordance with various fish and game statutes the division is obliged to conduct and hold hearings to determine facts incidental to the regulation of fish and game; such as the necessity for fish screens or fish ladders, the capacity of packing plants, the feasibility of issuing permits and so forth. At all these hearings the division is represented by the legal department. Twenty-nine hearings were held for the Commercial Fisheries Department of the division and three hearings were held on fish screen and ladder matters.

Appendix

STATISTICAL REPORTS

COMPARATIVE BALANCE SHEETS AT BEGINNING AND END OF EACH OF THE SEVENTY-EIGHTH AND SEVENTY-NINTH FISCAL YEARS

Debits	July 1, 1926	June 30, 1927	June 30, 1928
Available appropriated funds	$157,288 55	$162,589 92	$235,066 16
Warrants receivable	43,550 17	51,392 63	71,915 94
Cash, state	77,245 27		
Fish and game preservation fund	253,769 69	310,026 21	83,713 36
Accounts receivable	2 10	2 10	2 10
Bond deposits (licenses sold to agents)	66,508 00	21,861 00	136,804 00
Unissued licenses available	618,213 50	858,204 50	1,188,981 50
County clerks' unissued license supplies	303,869 00	143,128 70	322,736 00
Fish tags available	3,240 86	180 63	4,198 48
Game tags available	203 27	145 75	111 76
Revolving fund appropriated	12,500 00		22,000 00
Unclaimed trust moneys	259 45	259 45	208 85
Total debits	$1,536,649 86	$1,547,790 89	$2,065,738 15
Credits			
Appropriations for support	$10,669 10	$12,719 75	$26,150 96
Appropriations for salaries	275 01	889 52	
Deficiency appropriations	146,344 44	148,980 65	208,915 20
Claims filed	43,550 17	51,392 63	71,915 94
Accumulated excess income	343,517 06	310,028 31	105,715 46
Liability for bond deposit	66,508 00	21,861 00	136,804 00
Accountability for licenses	922,082 50	1,001,333 20	1,511,717 50
Accountability for fish tags	3,240 86	180 63	4,198 48
Accountability for game tags	203 27	145 75	111 76
Liability for cancelled checks	259 45	259 45	208 85
Total credits	$1,536,649 86	$1,547,790 89	$2,065,738 15

COMPARATIVE STATEMENT OF INCOME FOR THE FISCAL YEARS 1926-1927 AND 1927-1928

	Seventy-eighth fiscal year 1926–1927	Seventy-ninth fiscal year 1927–1928
License sales—		
Angling	$308,535 00	$213,451 10
Hunting	296,005 00	288,091 40
Market fishermen's	52,240 00	52,140 00
Trapping	3,879 00	5,449 00
Wholesale fish packers' and shell fish dealers'	1,260 00	1,445 00
Game breeders'	480 00	667 50
Fish breeders'	225 00	235 00
Kelp	10 00	30 00
Commercial hunting club		1,460 00
Commercial hunting club operators'		425 00
Deer tags		110,762 50
Total license sales	$662,634 00	$674,156 50
Other income—		
Court fines	$56,742 64	$72,109 79
Fish packers' tax	83,431 79	93,406 69
Kelp tax	6 59	14 76
Fish tag sales	6,060 23	5,547 15
Game tag sales	57 52	33 99
Abalone inspection	55 07	
Crawfish inspection	31 50	150 00
Interest on bank deposits	1,951 03	2,519 59
Miscellaneous sales	309 75	393 00
Total other income	$148,646 12	$174,174 97
Total income	$811,280 12	$848,331 47

STATEMENT OF EXPENDITURES FOR THE PERIOD JULY 1, 1927, TO JUNE 30, 1928, OF THE SEVENTY-NINTH FISCAL YEAR

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration—					
Executive and legal	$98 29	$16,356 94	$1,553 66	$1,593 91	$19,602 80
Clerical and office	978 16	18,634 01	2,731 87	742 91	23,086 95
Rent			10,363 36		10,363 36
Automobiles	383 16		382 65	20 75	786 56
Telephone and telegraph			5,249 08		5,249 08
Postage			3,978 60		3,978 60
Freight, cartage and express			2,298 51		2,298 51
Printing	18,035 79				18,035 79
Accident and death claims			1,311 46		1,311 46
Commissioners			1,010 70		1,010 70
Total administration	$19,495 40	$34,990 95	$28,879 89	$2,357 57	$85,723 81
Education—					
Director and assistants	$493 56	$13,302 10	$2,659 49	$6,880 76	$23,335 91
Publicity—					
Director		$3,300 00	$886 33		$4,186 33
State fair	$237 28	597 50	674 93	$18 45	1,528 16
Total publicity	$237 28	$3,897 50	$1,561 26	$18 45	$5,714 49
Conservation and protection—					
Chief and assistants		$12,895 00	$2,316 68	$91 25	$15,302 93
Clerical and office	$271 27	3,225 74	10 40	228 37	3,735 78
Rent			429 84		429 84
Automobiles	1,916 86		553 37	2,789 20	5,259 43
Captains and deputies	258 81	194,498 34	158,777 68	3,712 87	357,247 70
Patrol launches	1,450 85	2,095 00	1,332 36	4,805 02	9,683 23
Lion hunting		2,250 00	969 97		3,219 97
Lion bounties			7,900 00		7,900 00
Fish planting	226 77	3,271 00	1,392 41	2,983 88	7,874 06
Refuge posting	919 49	2,323 00	1,181 00	452 92	4,876 41
Total conservation and protection	$5,044 05	$220,558 08	$174,863 71	$15,063 51	$415,529 35
Commercial fisheries—					
Chief and assistants	$240 13	$9,948 35	$2,567 91	$282 96	$13,039 35
Deputies	1,141 63	28,220 80	7,978 24	45 99	37,386 66
Patrol launches	2,123 16	4,763 17	1,254 21	274 02	8,414 56
Statistical	407 19	5,670 00	298 29	150 00	6,525 48
Laboratory	1,506 24	32,035 78	5,853 28	1,997 39	41,392 69
Salmon tagging			238 00		238 00
Botulism			15,000 00		15,000 00
Automobiles	683 71		287 52		971 23
Carp eradication	19 05				19 05
Total commercial fisheries	$6,121 11	$80,638 10	$33,477 45	$2,750 36	$122,987 02
Fish culture—					
Chief and assistants		$4,083 35	$74 35	$20 20	$4,177 90
Clerical and office	$215 52	3,900 12	35 60		4,151 24
Rent			508 55		508 55
Automobiles	4,404 83		1,311 23	9,265 60	14,981 66
Hatcheries	54,188 05	123,199 53	18,657 81	23,463 87	219,509 26
Hatcheries, additions and betterments				53,165 76	53,165 76
Special field investigation	69 55	10,180 06	3,046 11	71 02	13,366 74
Total fish culture	$58,877 95	$141,363 06	$23,633 65	$85,986 45	$309,861 11
Hydraulics—					
Chief and assistants	$123 38	$5,395 00	$2,205 48	$1,695 64	$9,419 50
Cooperative research work	113 00	1,991 67	53 10		2,157 77
Total hydraulics	$236 38	$7,386 67	$2,258 58	$1,695 64	$11,577 27
Game propagation—					
Game farm, Yountville	$6,284 58	$8,578 50	$2,664 90	$3,066 56	$20,594 54
Automobiles	175 89		11 50		187 39
Game farm, Southern California				97 02	97 02
Total game propagation	$6,460 47	$8,578 50	$2,676 40	$3,163 58	$20,878 95
Research—					
Chief and assistants	$268 01	$9,285 76	$1,767 59	$106 84	$11,428 20
License commissions			$45,292 35		$45,292 35
Total Division of Fish and Game	$97,234 21	$520,000 72	$317,070 37	$118,023 16	$1,052,328 46

STATEMENT OF EXPENDITURES FOR THE PERIOD JULY 1, 1926, TO JUNE 30, 1927, OF THE SEVENTY-EIGHTH FISCAL YEAR

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration—					
Executive and legal	$18 00	$13,801 33	$1,058 29	$839 00	$15,716 62
Clerical and office	1,157 31	18,278 22	2,699 20	1,071 50	23,206 23
Rent			9,934 18		9,934 18
Telephone and telegraph			3,651 82		3,651 82
Postage			3,635 00		3,635 00
Freight, cartage and express			1,112 08		1,112 08
Printing	10,181 30				10,181 30
Automobiles	325 30		323 08	1,790 56	2,438 94
Tahoe Camp Grounds	96 64	566 67	30 88	45 67	739 86
Accident and death claims			1,530 53		1,530 53
Total administration	$11,778 55	$32,646 22	$23,975 06	$3,746 73	$72,146 56
Education—					
Director and assistants	$234 34	$7,098 49	$1,016 29	$977 67	$9,326 79
Publicity—					
Director		$3,498 00	$1,070 43		$4,568 43
State fair	$263 67	443 50	1,604 83		2,312 00
Total publicity	$263 67	$3,941 50	$2,675 26		$6,880 43
Conservation and protection—					
Chief and assistants	$155 56	$7,819 94	$746 52	$33 46	$8,755 48
Clerical and office	64 97	4,573 40	4 65	93 31	4,736 33
Rent			370 20		370 20
Captains and deputies	2,282 77	149,256 44	119,704 08	883 01	272,126 30
Patrol launches	1,304 86	2,092 23	797 25	133 55	4,327 89
Automobiles	737 53		447 42	2,023 80	3,208 75
Lion hunting		1,620 00	830 93		2,450 93
Lion bounties			5,820 00		5,820 00
Statistics and game problems	295 60	2,860 00	348 73	1,584 43	5,088 76
Total conservation and protection	$4,841 29	$168,222 01	$129,069 78	$4,751 56	$396,884 64
Commercial fisheries—					
Chief and assistants	$1,403 45	$12,961 48	$1,811 89	$177 62	$16,354 44
Deputies	25 66	17,663 26	5,054 52	215 95	22,959 39
Laboratory	939 27	25,289 02	5,191 50	2,216 01	33,635 80
Statistical	97 89	4,633 52	360 42	7 36	5,099 19
Patrol launches	2,311 01	2,260 00	1,162 01	142 86	5,875 88
Salmon tagging	801 60	143 33	1,228 31		2,173 24
Botulism			15,000 00		15,000 00
Total commercial fisheries	$5,578 88	$62,950 61	$29,808 65	$2,759 80	$101,097 94
Fish culture—					
Chief and assistants	$157 17	$3,899 94	$134 89		$4,192 00
Clerical and office	68 09	3,840 00	36 80	$63 14	4,008 03
Special field investigation	53 25	7,231 45	1,663 71	88 91	9,037 32
Hatcheries	40,534 54	83,124 57	9,975 56	2,582 31	136,216 98
Hatcheries, additions and betterments				86,356 15	86,356 15
Automobiles	3,624 68		1,177 57	9,603 06	14,405 31
Rent			750 80		750 80
Total fish culture	$44,437 73	$98,095 96	$13,739 33	$98,693 57	$254,966 59
Screens, ladders and pollution—					
Chief and assistants	$25 34	$8,510 32	$2,629 39	$442 28	$11,607 33
Game propagation—					
Game farm	$5,507 66	$8,167 71	$1,544 94	$3,727 10	$18,947 41
Game farm, additions and betterments				1,020 38	1,020 38
Total game propagation	$5,507 66	$8,167 71	$1,544 94	$4,747 48	$19,967 79
License commissions			$53,581 90		$53,581 90
Total expenditures	$72,667 46	$389,632 82	$258,040 60	$116,119 09	$836,459 97

HUNTING LICENSE SALES—July 1, 1927, TO JUNE 30, 1928

County	Total	Citizen	Non-resident	Alien	Declarant-alien
Alameda	$13,269 00	$12,549 00	$40 00	$250 00	$430 00
Alpine	60 00	40 00	20 00		
Amador	906 00	866 00			40 00
Butte	5,164 00	5,064 00	20 00		80 00
Calaveras	992 00	982 00	10 00		
Colusa	2,387 00	2,297 00	20 00	50 00	20 00
Contra Costa	3,579 00	3,379 00		100 00	100 00
Del Norte	876 00	756 00	50 00	50 00	20 00
El Dorado	1,413 00	1,363 00	20 00		30 00
Fresno	10,600 00	10,395 00		75 00	130 00
Glenn	1,815 00	1,725 00	20 00	50 00	20 00
Humboldt	5,669 00	5,304 00	30 00	175 00	160 00
Imperial	1,754 00	1,729 00		25 00	
Inyo	1,951 00	1,906 00	20 00	25 00	
Kern	8,036 00	8,016 00			20 00
Kings	1,623 00	1,593 00			30 00
Lake	1,906 00	1,886 00	10 00		10 00
Lassen	2,472 00	2,177 00	110 00	75 00	110 00
Los Angeles	53,065 00	52,340 00	100 00	375 00	190 00
Madera	1,444 00	1,374 00	10 00		60 00
Marin	2,013 00	2,013 00			
Mariposa	403 00	403 00			
Mendocino	3,648 00	3,548 00			100 00
Merced	3,411 00	3,256 00		75 00	80 00
Modoc	8,001 00	1,371 00	6,630 00		
Mono	471 00	411 00	60 00		
Monterey	4,294 00	3,989 00	20 00	125 00	160 00
Napa	2,786 00	2,391 00		125 00	270 00
Nevada	1,202 00	1,137 00	30 00	25 00	10 00
Orange	4,730 00	4,720 00			10 00
Placer	3,325 00	2,945 00	70 00	50 00	260 00
Plumas	1,666 00	1,606 00	20 00		40 00
Riverside	5,138 00	5,118 00			20 00
Sacramento	8,598 00	7,783 00	50 00	225 00	540 00
San Benito	1,418 00	1,348 00	10 00		60 00
San Bernardino	5,620 00	5,600 00			20 00
San Diego	10,505 00	10,300 00	10 00	175 00	20 00
San Francisco	18,208 00	14,718 00	80 00	1,200 00	2,210 00
San Joaquin	6,630 00	6,430 00			200 00
San Luis Obispo	3,199 00	3,135 00		25 00	30 00
San Mateo	2,798 00	2,408 00		250 00	140 00
Santa Barbara	4,221 00	4,056 00	10 00	75 00	80 00
Santa Clara	7,581 00	7,211 00	10 00	150 00	210 00
Santa Cruz	3,225 00	2,655 00		200 00	370 00
Shasta	2,577 00	2,477 00	30 00		70 00
Sierra	344 00	319 00		25 00	
Siskiyou	13,685 00	5,305 00	7,740 00	150 00	490 00
Solano	2,956 00	2,861 00		25 00	70 00
Sonoma	7,285 00	6,645 00	20 00	200 00	420 00
Stanislaus	4,551 00	4,441 00	10 00		100 00
Sutter	883 00	833 00	10 00		40 00
Tehama	2,803 00	2,723 00	20 00	50 00	10 00
Trinity	538 00	538 00			
Tulare	4,707 00	4,697 00			10 00
Tuolumne	1,529 00	1,519 00			10 00
Ventura	3,613 00	3,603 00			10 00
Yolo	2,294 00	2,244 00			50 00
Yuba	2,150 00	2,110 00			40 00
Nevada (state of)	610 00		610 00		
Oregon (state of)	2,834 00	354 00	2,480 00		
Total sales	$285,362 00	$254,962 00	$18,400 00	$4,400 00	$7,600 00
Total number of licenses	257,738	254,962	1,840	176	760

HUNTING LICENSE SALES—July 1, 1926, TO JUNE 30, 1927

County	Total	Citizen	Non-resident	Alien	Declarant-alien
Alameda	$14,296 00	$13,576 00	$10 00	$200 00	$510 00
Alpine	156 00	76 00	80 00		
Amador	935 00	905 00			30 00
Butte	5,410 00	5,340 00			70 00
Calaveras	1,024 00	1,024 00			
Colusa	2,357 00	2,312 00		25 00	20 00
Contra Costa	3,712 00	3,472 00		150 00	90 00
Del Norte	1,002 00	837 00	110 00	25 00	30 00
El Dorado	1,604 00	1,554 00	20 00		30 00
Fresno	10,168 00	9,978 00		100 00	90 00
Glenn	1,671 00	1,621 00	30 00		20 00
Humboldt	5,331 00	5,111 00	10 00	100 00	110 00
Imperial	1,316 00	1,241 00		75 00	
Inyo	1,764 00	1,754 00	10 00		
Kern	6,023 00	5,993 00			30 00
Kings	1,388 00	1,368 00			20 00
Lake	2,118 00	2,088 00			30 00
Lassen	2,714 00	2,524 00	30 00	50 00	110 00
Los Angeles	48,474 00	47,654 00	170 00	400 00	250 00
Madera	1,544 00	1,514 00			30 00
Marin	2,139 00	2,139 00			
Mariposa	277 00	277 00			
Mendocino	4,000 00	3,875 00		25 00	100 00
Merced	2,588 00	2,553 00	10 00	25 00	
Modoc	5,229 00	1,389 00	3,820 00		20 00
Mono	394 00	354 00	40 00		
Monterey	4,049 00	3,824 00		125 00	100 00
Napa	2,863 00	2,563 00	10 00	50 00	240 00
Nevada	1,330 00	1,255 00	40 00	25 00	10 00
Orange	4,482 00	4,472 00			10 00
Placer	3,532 00	3,042 00	80 00	100 00	310 00
Plumas	1,855 00	1,795 00	40 00		20 00
Riverside	5,513 00	5,493 00			20 00
Sacramento	9,236 00	8,321 00	80 00	375 00	460 00
San Benito	1,350 00	1,235 00		25 00	90 00
San Bernardino	5,290 00	5,245 00	10 00	25 00	10 00
San Diego	9,388 00	9,158 00	50 00	150 00	30 00
San Francisco	18,593 00	15,183 00	130 00	850 00	2,430 00
San Joaquin	7,000 00	6,700 00		100 00	200 00
San Luis Obispo	3,162 00	3,027 00		75 00	60 00
San Mateo	2,884 00	2,319 00		175 00	390 00
Santa Barbara	4,665 00	4,465 00	10 00	100 00	90 00
Santa Clara	7,670 00	7,335 00		175 00	160 00
Santa Cruz	3,196 00	3,036 00			160 00
Shasta	2,943 00	2,853 00	20 00		70 00
Sierra	388 00	343 00		25 00	20 00
Siskiyou	15,390 00	5,455 00	9,210 00	125 00	600 00
Solano	3,218 00	3,093 00		25 00	100 00
Sonoma	8,060 00	7,425 00	10 00	225 00	400 00
Stanislaus	4,212 00	4,097 00		25 00	90 00
Sutter	1,003 00	973 00	10 00		20 00
Tehama	2,153 00	2,143 00			10 00
Trinity	683 00	663 00	20 00		
Tulare	5,485 00	5,440 00	10 00	25 00	10 00
Tuolumne	1,537 00	1,507 00			30 00
Ventura	3,232 00	3,212 00			20 00
Yolo	2,363 00	2,263 00			100 00
Yuba	2,231 00	2,146 00		25 00	60 00
Nevada (state of)	600 00		600 00		
Oregon (state of)	2,511 00	281 00	2,230 00		
Total sales	$279,701 00	$250,891 00	$16,900 00	$4,000 00	$7,910 00
Total number of licenses	253,532	250,891	1,690	160	791

ANGLING LICENSE SALES—JANUARY 1, 1927, TO DECEMBER 31, 1927

County	Total	Citizen	Non-resident	Alien
Alameda	$18,091 00	$17,593 00	$15 00	$483 00
Alpine	310 00	115 00	195 00	
Amador	908 00	890 00		18 00
Butte	5,248 00	5,092 00	24 00	132 00
Calaveras	1,026 00	1,020 00		6 00
Colusa	852 00	837 00	3 00	12 00
Contra Costa	3,992 00	3,917 00	9 00	66 00
Del Norte	1,190 00	1,082 00	90 00	18 00
El Dorado	2,248 00	2,176 00	27 00	45 00
Fresno	11,578 00	11,029 00	21 00	528 00
Glenn	1,017 00	1,017 00		
Humboldt	6,043 00	5,902 00	21 00	120 00
Imperial	602 00	569 00	30 00	3 00
Inyo	6,246 00	6,039 00	81 00	126 00
Kern	3,910 00	3,901 00	3 00	6 00
Kings	865 00	829 00		36 00
Lake	1,690 00	1,690 00		
Lassen	2,601 00	2,475 00	54 00	72 00
Los Angeles	46,411 00	45,718 00	141 00	552 00
Madera	1,536 00	1,503 00	6 00	27 00
Marin	1,908 00	1,908 00		
Mariposa	2,210 00	2,108 00	102 00	
Mendocino	3,526 00	3,436 00	12 00	78 00
Merced	1,750 00	1,717 00	6 00	27 00
Modoe	955 00	907 00	45 00	3 00
Mono	1,537 00	1,069 00	429 00	39 00
Monterey	3,151 00	2,986 00	12 00	153 00
Napa	3,004 00	2,926 00	21 00	57 00
Nevada	2,250 00	2,112 00	54 00	84 00
Orange	3,089 00	3,068 00	3 00	18 00
Placer	3,411 00	3,180 00	27 00	204 00
Plumas	2,857 00	2,683 00	81 00	93 00
Riverside	2,685 00	2,628 00	9 00	48 00
Sacramento	13,283 00	10,286 00	120 00	2,877 00
San Benito	548 00	530 00		18 00
San Bernardino	9,285 00	9,213 00	18 00	54 00
San Diego	8,466 00	8,400 00	48 00	18 00
San Francisco	24,252 00	22,149 00	111 00	1,992 00
San Joaquin	7,619 00	6,935 00	15 00	669 00
San Luis Obispo	1,417 00	1,405 00		12 00
San Mateo	1,876 00	1,771 00		105 00
Santa Barbara	2,434 00	2,386 00	12 00	36 00
Santa Clara	7,508 00	7,358 00	9 00	141 00
Santa Cruz	3,794 00	3,386 00	3 00	405 00
Shasta	3,039 00	2,952 00	30 00	57 00
Sierra	701 00	638 00	27 00	36 00
Siskiyou	6,414 00	5,613 00	321 00	480 00
Solano	3,744 00	3,336 00		408 00
Sonoma	7,482 00	7,281 00	30 00	171 00
Stanislaus	4,472 00	4,385 00	6 00	81 00
Sutter	952 00	934 00		18 00
Tehama	1,576 00	1,555 00	18 00	3 00
Trinity	388 00	385 00		3 00
Tulare	5,152 00	5,065 00	27 00	60 00
Tuolumne	2,201 00	2,147 00	12 00	42 00
Ventura	2,449 00	2,410 00	9 00	30 00
Yolo	1,261 00	1,192 00		69 00
Yuba	1,680 00	1,590 00	3 00	87 00
Nevada (state of)	2,501 00	2 00	2,499 00	
Oregon (state of)	11 00	2 00	9 00	
Total license sales	$273,202 00	$257,428 00	$4,848 00	$10,926 00
Total number of licenses	262,886	257,428	1,616	3,842

ANGLING LICENSE SALES, BY COUNTIES—JANUARY 1, 1926, TO DECEMBER 31, 1926

Counties	Total	Citizen	Non-resident	Alien
Alameda	$16,082 00	$15,629 00	$3 00	$450 00
Alpine	502 00	130 00	351 00	21 00
Amador	873 00	855 00		18 00
Butte	5,063 00	4,901 00	27 00	135 00
Calaveras	945 00	942 00		3 00
Colusa	875 00	866 00		9 00
Contra Costa	3,691 00	3,613 00		78 00
Del Norte	1,196 00	1,070 00	114 00	12 00
El Dorado	2,089 00	1,999 00	24 00	66 00
Fresno	10,337 00	9,845 00	21 00	471 00
Glenn	806 00	803 00		3 00
Humboldt	6,248 00	6,113 00	21 00	114 00
Imperial	510 00	510 00		
Inyo	5,995 00	5,791 00	111 00	93 00
Kern	3,270 00	3,243 00	9 00	18 00
Kings	751 00	721 00	3 00	27 00
Lake	1,533 00	1,521 00	9 00	3 00
Lassen	2,337 00	2,265 00	18 00	54 00
Los Angeles	43,404 00	42,783 00	93 00	528 00
Madera	1,296 00	1,275 00	3 00	18 00
Marin	1,907 00	1,907 00		
Mariposa	1,829 00	1,733 00	75 00	21 00
Mendocino	3,642 00	3,552 00	9 00	81 00
Merced	1,416 00	1,389 00	3 00	24 00
Modoc	992 00	932 00	48 00	12 00
Mono	1,285 00	910 00	330 00	45 00
Monterey	2,818 00	2,716 00	6 00	96 00
Napa	2,683 00	2,632 00	6 00	45 00
Nevada	2,144 00	1,955 00	45 00	144 00
Orange	2,736 00	2,724 00	6 00	6 00
Placer	3,182 00	3,005 00	18 00	159 00
Plumas	2,839 00	2,662 00	48 00	129 00
Riverside	2,464 00	2,401 00		63 00
Sacramento	11,669 00	8,732 00	222 00	2,715 00
San Benito	487 00	481 00		6 00
San Bernardino	7,929 00	7,851 00	21 00	57 00
San Diego	7,562 00	7,478 00	60 00	24 00
San Francisco	23,127 00	21,066 00	120 00	1,941 00
San Joaquin	8,720 00	8,024 00		696 00
San Luis Obispo	1,291 00	1,276 00	3 00	12 00
San Mateo	1,552 00	1,453 00		99 00
Santa Barbara	2,555 00	2,513 00		42 00
Santa Clara	6,956 00	6,845 00	15 00	96 00
Santa Cruz	3,575 00	3,251 00		324 00
Shasta	2,897 00	2,831 00	9 00	57 00
Sierra	689 00	641 00	15 00	33 00
Siskiyou	7,160 00	6,242 00	489 00	429 00
Solano	3,474 00	3,012 00		462 00
Sonoma	7,003 00	6,808 00	9 00	186 00
Stanislaus	3,991 00	3,907 00	12 00	72 00
Sutter	873 00	849 00		24 00
Tehama	1,576 00	1,543 00	12 00	21 00
Trinity	419 00	419 00		
Tulare	5,237 00	5,117 00	18 00	102 00
Tuolumne	2,178 00	2,112 00	12 00	54 00
Ventura	2,397 00	2,340 00	3 00	54 00
Yolo	1,123 00	1,081 00		42 00
Yuba	1,760 00	1,652 00		108 00
Nevada (state of)	49 00	19 00	30 00	
Oregon (state of)	2,640 00		2,640 00	
Total sales	$256,629 00	$240,936 00	$5,091 00	$10,602 00
Total number of licenses	246,167	240,936	1,697	3,534

MARKET FISHERMEN'S LICENSE SALES

Total sales, license year April 1, 1926, to March 31, 1927	$50,780 00
Total sales, license year April 1, 1927, to March 31, 1928	52,050 00

License fee: All persons, $10.

TRAPPING LICENSE SALES

Total sales, license year July 1, 1926, to June 30, 1927	$3,872 00
Total sales, license year July 1, 1927, to June 30, 1928	5,347 00

License fee: Citizens, $1; aliens, $2.

FISH PACKERS' AND WHOLESALE SHELL-FISH DEALERS' LICENSE SALES

Total sales, license year July 1, 1926, to June 30, 1927	$1,280 00
Total sales, license year July 1, 1927, to June 30, 1928	1,275 00

License fee: Citizens, $5; aliens, $20.

GAME BREEDERS' LICENSE SALES

Total sales, license year January 1, 1926, to December 31, 1926	$410 00
Total sales, license year January 1, 1927, to December 31, 1927	502 50

License fee: All persons, $2.50.

FISH BREEDERS' LICENSE SALES

Total sales, license year January 1, 1926, to December 31, 1926	$140 00
Total sales, license year January 1, 1927, to December 31, 1927	190 00

License fee: All persons, $5.

DOMESTICATED FISH IMPORTERS' LICENSE SALES

Total sales, license year January 1, 1926, to December 31, 1926	None
Total sales, license year January 1, 1927, to December 31, 1927	None

License fee: All persons, $5.

KELP LICENSE SALES

Total sales, year 1926	$10 00
Total sales, year 1927	20 00

License for term of one year from date of issuance. Fee, $10.

COMMERCIAL HUNTING GUN CLUB LICENSE SALES

Total sales, year June 30, 1927-1928	$1,475 00

License fee: Citizens, $25; aliens, $100.

COMMERCIAL HUNTING CLUB OPERATORS' LICENSE SALES

Total sales, June 30, 1927, to July 1, 1928	$410 00

License fee: Citizens, $5; aliens, $25.

ARRESTS AND CONVICTIONS

RECAPITULATION

	Number of arrests	Fines and forfeitures imposed	Jail sentences (days)
Fish cases, 1926–1927	760	$23.508 00	2,485
Game cases, 1926-1927	1,079	35,895 00	2,230
Totals, 1926–1927	1,839	$59,403 00	4,715
Fish cases, 1927–1928	1,313	$41,749 00	1,517
Game cases, 1927–1928	1,238	45,997 50	2,272
Totals, 1927–1928	2,551	$87,746 50	3,789
Recapitulation—			
1926–1927	1,839	$59,403 00	4,715
1927–1928	2,551	87,746 50	3,789
Totals	4,390	$147,149 50	8,504

TOTAL ARRESTS FOR A PERIOD OF TWENTY-SIX YEARS

1902–1904	550
1904–1906	774
1906–1908	1,192
1908–1910	1,771
1910–1912	2,063
1912–1914	1,993
1914–1916	2,087
1916–1918	1,797
1918–1920	1,891
1920–1922	2,258
1922–1924	2,715
1924–1926	3,207
1926–1928	4,390

FISH CASES

	July 1, 1926, to June 30, 1927			July 1, 1927, to June 30, 1928		
	Number of arrests.	Fines and forfeitures imposed.	Jail sentence (days).	Number of arrests.	Fines and forfeitures imposed.	Jail sentence (days).
Violations Angling License Act	51	$1,135 00	120	251	$5,915 00	352
Violations Commercial Fishing License Act	58	575 00	------	74	950 00	------
Trout—taking and possession closed season; other than hook and line; over bag limit; offering for sale	85	3,408 00	90	132	4,255 00	250
Striped bass—closed season sale—undersized; over bag limit; shipment out of state	66	1,945 00	150	112	4,220 00	125
Black bass—taking and possession closed season; over bag limit, undersized	15	365 00	180	55	1,230 00	90
Sunfish, perch, crappie—taking and possession closed season	15	315 00	40	35	790 00	------
Catfish—sale of undersized	4	80 00	------	9	285 00	------
Salmon—closed season sale; over bag limit, illegal taking and possession	11	775 00	10	14	650 00	60
Barracuda—undersized	8	255 00	------	17	580 00	------
Halibut—undersized	2	45 00	------	------	------	------
Fish, young—illegal taking	1	20 00	------	------	------	------
Clams—taking and possession closed season; over bag limit; undersized	103	2,855 00	780	169	4,709 00	470
Abalones—taking and possession closed season; taking with diving apparatus; over bag limit; undersized	176	5,005 00	------	211	5,485 00	30
Crabs—taking and possession closed season; females; undersized; transporting from District 1½	27	1,150 00	120	31	685 00	------
Lobsters—taking and possession closed season; over bag limit; undersized	36	1,325 00	------	27	890 00	30
Spotfin croaker—illegal sale	1	25 00	------	1	50 00	------
Salt water eels—over bag limit	1	20 00	------	------	------	------
Sea lions—illegal killing	1	100 00	------	------	------	------
Fish spear—illegal possession or use	1	25 00	------	31	645 00	35
Fishing—within 250 feet of fishway, within 150 feet of lower side of dam, within 150 feet of upper side of fish screens	21	255 00	------	12	205 00	------
Illegal fishing—fish reservation	8	225 00	------	3	100 00	------
Illegal fishing—closed stream or lake	------	------	------	37	1,200 00	75
Illegal night fishing	9	305 00	------	9	280 00	------
Fish, shell fish—illegal shipment	1	------	90	------	------	------
Water poilution; use of explosives to take fish	7	700 00	------	22	3,900 00	------
Nets, traps, lines—illegal possession or use	52	2,600 00	905	61	4,725 00	------
Total fish cases	760	$23,508 00	2,485	1,313	$41,749 00	1,517

GAME CASES

	July 1, 1926, to June 30, 1927			July 1, 1927, to June 30, 1928		
	Number of arrests	Fines and forfeitures imposed	Jail sentence (days)	Number of arrests	Fines and forfeitures imposed	Jail sentence (days)
Violations, Hunting License Act	203	$3,275 00	190	236	$5,045 00	62
Violations, Deer Tag License Act	------	------	------	49	1,885 00	------
Violations, Commercial Gun Club License Act	------	------	------	3	200 00	30
Deer, buy or sell; run with dogs; taking and possession, closed season; failure to retain horns and hide; over bag limit	108	5,175 00	180	127	10,585 00	260
Deer—taking and possession does, fawns, spiked bucks; forked-horn deer in District 1¾	89	5,684 00	250	89	7,360 00	435
Rabbits, cottontail, brush—taking and possession closed season	129	3,355 00	65	159	3,585 00	615
Squirrels, tree—taking and possession (no open season)	11	235 00	------	3	75 00	------
Ducks—buy or sell; taking and possession closed season; over bag limit	46	1,675 00	270	74	2,222 50	235
Geese—taking and possession closed season; over bag limit	5	100 00	------	14	375 00	30
Swans—taking and possession (no open season)	5	150 00	60	3	75 00	------
Mudhens—taking and possession closed season	3	25 00	5	9	300 00	30
Shore birds—taking and possession (no open season)	14	435 00	------	40	1,060 00	------
Doves—taking and possession closed season; over bag limit	60	1,762 00	125	64	1,795 00	------
Pigeons, wild—taking and possession (no open season)	13	550 00	------	9	225 00	50
Quail—taking and possession closed season; over bag limit	113	4,489 00	290	112	4,295 00	335
Grouse—closed season	3	50 00	------	------	------	------
Pheasants—illegal taking or possession	15	1,435 00	------	15	1,425 00	------
Sage hens—taking and possession closed season; over bag limit	7	350 00	------	3	100 00	------
Non-game birds—taking and possession	115	3,880 00	140	49	1,185 00	10
Trespass	24	435 00	------	24	550 00	------
Bird nets, traps—illegal possession or use	11	325 00	------	4	55 00	------
Game refuge—hunting and possession of fire arms	23	485 00	------	37	685 00	50
Night hunting	48	1,180 00	655	79	2,195 00	60
Shoot game from automobile, power or sail boat; illegal use of scull boat	23	605 00	------	17	315 00	60
Guns—illegal possession	2	125 00	------	------	------	------
Guns—illegal shipment	------	------	------	2	50 00	------
Violations, fur trapping regulations	9	115 00	------	17	355 00	10
Total game cases	1,079	$35,895 00	2,230	1,238	$45,997 50	2,272

SEIZURES OF FISH AND GAME

	July 1, 1926 to June 30, 1927	July 1, 1927 to June 30, 1928	Total
Trout	1,925	1,921	3,846
Black bass	49	363	412
Sunfish, crappie, perch	287	496	783
Catfish (pounds)	16	812	828
Striped bass (pounds)	2,782	1,154	3,936
Salmon (pounds)	2,150	7,192	9,342
Barracuda (pounds)	6,908	30,818	37,726
Spotfin croaker (pounds)	125	1,090	1,215
Salt water perch (pounds)	150		150
Halibut (pounds)	222		222
Herring (pounds)	560		560
Crabs	2,670	496	3,166
Crab meat (pounds)	690		690
Clams	3,073	5,043	8,116
Abalones	2,970	895	3,865
Abalone meat (pounds)		39	39
Lobsters (pounds)	2,257	898	3,155
Shrimp meat (pounds)	25		25
Sturgeon	1		1
Miscellaneous fish	240	5	245
Net traps	14	21	35
Deer meat (pounds)	4,876	6,057	10,933
Deer heads	4	3	7
Deer hides	4	6	10
Deer fawns, live		3	3
Squirrels	8		8
Rabbits—Sierra hare, Brush cottontail	239	147	386
Ducks	1,482	839	2,321
Geese	108	147	255
Swans		1	1
Mudhens	1	6	7
Shore birds	14	54	68
Doves	256	427	683
Pigeons	18	7	25
Quail	306	436	742
Sage hens	31	27	58
Pheasants	11	20	31
Non-game birds	320	127	447
Bird nets, traps	3	2	5
Fur bearing animals—skins	1	22	23

REPORT OF OPERATIONS OF LICENSED GAME BREEDERS

	Sold during 1926	On hand December 31, 1926	Sold during 1927	On hand December 31, 1927
Pheasants—				
Ringnecked	2,299	1,569	2,564	1,849
Mongolian	11	32	36	143
Silver	25	102	70	148
Golden	93	154	166	356
Reeves	22	31	28	115
Lady Amherst	42	53	30	111
Other species	111	139	57	212
Ducks—				
Mallard	3,468	3,431	2,545	2,365
Sprig (pintail)	2	60	2	101
Wood duck		56	48	111
Other species	2	59	32	46
Quail—				
Valley	951	867	2,196	2,710
Mountain	22	32	386	193
Gambel	138	34	346	215
Scaled		5	1	10
Bob-white	37	70	51	95
Partridge—				
Hungarian				26
Doves—				
Mourning	103	66	88	211
Other species	24	102	14	177
Geese—				
All species	4	40	15	27
Squirrels—				
All species				59
Deer—				
All species				69

Number of game breeders' licenses sold in 1926: 164.
Number of game breeders' licenses sold in 1927: 201.

SUMMARY OF FISH DISTRIBUTION, SEASON 1926-1927

Hatchery	Rainbow	Loch Leven	Steelhead	Eastern brook	German brown	Large lake	Cutthroat
Bear Lake	2,407,000						
Big Creek	100,000		327,000				
Brookdale			903,000				
Clear Creek	485,936						
Domingo Springs	1,195,029		40,000				
Fall Creek	551,000						
Feather River	755,000	295,000	154,000	476,500			
Fort Seward	875,690		1,963,680				166,000
Kaweah	268,000		343,585				
Mt. Shasta	4,913,000	8,369,460	541,970	3,807,840	3,906,219		28,000
Mt. Tallac						1,310,000	
Mt. Whitney	2,299,000	677,000	2,179,500	1,065,000			
North Creek	1,100,000						
Fern Creek			500,000				
Tahoe	116,000	34,000	327,500	186,000		1,048,500	90,000
Ukiah			1,465,000				
Wawona	340,720		298,850				
Yosemite			566,000				
Transplantation							
Totals	15,406,375	9,375,460	9,610,085	5,535,340	3,906,219	2,358,500	284,000

SUMMARY OF FISH DISTRIBUTION, SEASON 1926-1927

Hatchery	Black spotted	Mackinaw	Golden	Salmon	Crappies	Blue gills	Catfish
Bear Lake							
Big Creek							
Brookdale							
Clear Creek							
Domingo Springs	138,850						
Fall Creek				7,527,000			
Feather River	290,400						
Fort Seward	248,230			1,898,590			
Kaweah							
Mt. Shasta	265,000	103		17,303,000			
Mt. Tallac	300,000						
Mt. Whitney	740,000		821,000				
North Creek							
Fern Creek	1,047,000						
Tahoe	1,118,000						
Ukiah							
Wawona							
Yosemite							
Transplantation					672	5,559	5,000
Totals	4,147,480	103	821,000	26,728,590	672	5,559	5,000

RECAPITULATION, SEASON 1926-1927

Trout	51,444,562
Salmon	26,728,590
Grand total	78,173,152

FISH DISTRIBUTION BY COUNTIES, SEASON 1027

MT. SHASTA HATCHERY

County	Rainbow	Loch Leven	Steelhead	Eastern brook	German brown	Brown spotted	Salmon
Alameda		34,000			6,000		
Alpine			16,000				
Amador	100,000	40,000	40,000	70,000	20,000		
Butte	146,700	42,000	88,000	35,000		30,000	
Calaveras	55,000	20,000	15,000		370,000		
Colusa	32,000						
Del Norte				78,000			
El Dorado	100,000	149,960	150,000	60,990	10,000		
Fresno		508,000			130,000		
Glenn	22,950						
Kern		140,000					
Lake	12,000	49,000			175,000		
Lassen		484,000					
Los Angeles		5,000			20,000		
Madera	30,000	64,000		64,500	10,000		
Marin	20,000	64,000					
Mariposa	14,000	231,000		18,000			
Mendocino				5,000	250,000		
Merced		132,000					
Modoc		58,000	6,000	141,850			
Monterey	10,000	228,000			12,000		
Napa	62,000	386,000			40,000		
Nevada	191,000	317,000		10,000		20,000	
Placer	113,000	319,000	25,000	28,000	55,000		
Plumas	17,200	461,000		9,000			
San Benito					8,000		
Santa Cruz				15,000			
Shasta	147,000	84,500		99,000	19,000	35,000	
Siskiyou	118,500	72,000	20,000	183,000		50,000	6,055,000
Sonoma					420,000		
Tehama	139,850	5,000	25,000	34,000	4,000		
Trinity	20,000	10,000	156,970	124,000	5,000		
Tulare		60,000			454,000		
Tuolumne	45,500	327,000		82,000			
Yuba	3,800						
Totals	1,400,500	4,290,460	541,970	1,057,340	2,008,000	135,000	6,055,000

FALL CREEK HATCHERY

County	Rainbow	Salmon
Siskiyou	219,000	3,762,000

MOUNT WHITNEY HATCHERY

County	Rainbow	Loch Leven	Steelhead	Eastern brook	Black spotted	Golden
Alpine	34,000				55,000	
Fresno	5,000		48,000	158,000		
Inyo	274,000	180,000	55,000	125,000	116,000	320,000
Kern			186,000	10,000		
Los Angeles	14,000			28,000		
Mono	179,000			223,000	199,000	81,000
Monterey	126,000	30,000	154,000	10,000	70,000	
Nevada	3,000		42,000			
Orange	6,000		2,000	8,000		
Riverside			15,000	28,000		
San Luis Obispo		67,000	242,500			
Santa Barbara	20,000	55,000	10,000	32,000		
Sierra	12,000		133,000			
Tulare			94,000	47,000		
Ventura	139,000	8,000	65,000			
Totals	812,000	340,000	1,046,500	669,000	440,000	401,000

FERN CREEK HATCHERY

County	Steelhead	Black spotted
Alpine	109,000	
Mono	376,000	547,000
Tuolumne	15,000	
Totals	500,000	547,000

FORT SEWARD HATCHERY

County	Rainbow	Steelhead	Black spotted	Cut-throat
Humboldt	144,180	669,070	148,900	166,000
Marin		180,000		
Sonoma		249,000		
Mendocino	65,000			
Totals	209,180	1,098,070	148,900	166,000

UKIAH HATCHERY

County	Steelhead
Lake	145,000
Mendocino	570,000
Total	715,000

TAHOE HATCHERY

County	Rainbow	Loch Leven	Steelhead	Eastern brook	Black spotted	Large lake
Calaveras						20,000
Del Norte						146,000
El Dorado	6,000	34,000	257,500	186,000	75,000	57,500
Nevada			70,000			
Placer					289,000	
Siskiyou					4,000	
Totals	6,000	34,000	327,500	186,000	368,000	223,500

TALLAC HATCHERY

County	Large lake
El Dorado	900,000

CLEAR CREEK HATCHERY

County	Rainbow
Lassen	237,936
Placer	198,000
Total	435,936

DOMINGO SPRINGS

County	Rainbow	Steelhead	Black spotted
Lassen	183,064		
Plumas	356,580	40,000	138,850
Totals	539,644	40,000	138,850

BEAR LAKE HATCHERY

County	Rainbow
Riverside	20,000
San Bernardino	1,012,000
Total	1,032,000

NORTH CREEK HATCHERY

County	Rainbow
Los Angeles	139,000
Riverside	73,000
San Bernardino	288,000
Total	500,000

BIG CREEK HATCHERY

County	Rainbow	Steelhead
San Mateo	32,000	15,000
Santa Clara		140,000
Santa Cruz	68,000	172,000
Totals	100,000	327,000

BROOKDALE HATCHERY

County	Steelhead
San Mateo	10,000
Santa Cruz	211,000
Total	221,000

FEATHER RIVER HATCHERY

County	Rainbow	Loch Leven	Steelhead	Eastern brook	Black spotted
Nevada	15,000			41,000	
Plumas	25,000	70,000	15,000	35,000	
Sierra	115,000	43,000	139,000	132,000	178,000
Totals	155,000	113,000	154,000	208,000	178,000

WAWONA HATCHERY

County	Rainbow	Steelhead
Mariposa	96,620	142,650
Tuolumne		60,000
Totals	96,620	202,650

KAWEAH HATCHERY

County	Steelhead
Fresno	19,000
Tulare	259,585
Total	278,585

YOSEMITE HATCHERY

County	Steelhead
Mariposa	376,000
Tuolumne	190,000
Total	566,000

TRANSPLANTATION

County	Catfish	Blue gill
San Bernardino	650	1,350
Stanislaus	50	75
Totals	700	1,425

FISH DISTRIBUTION BY COUNTIES, SEASON 1926

Mount Shasta Hatchery

County	Rainbow	Loch Leven	Eastern brook	German brown	Salmon	Cut-throat	Black spotted
Alameda	50,000						
Alpine	70,000		25,000				
Amador	121,000	215,000	113,000				
Butte	260,000	50,000	197,000				
Calaveras	95,000	230,000	25,000	50,000			
Colusa	40,000		4,000				
El Dorado	155,000	390,000	234,000				
Fresno	205,000	450,000	275,000	25,000			
Glenn	24,000		8,000				
Kern	80,000		80,000				
Lake	20,000	12,000	15,500	310,000			
Los Angeles				16,000			
Madera	62,000		94,000				
Marin	20,000	65,000					
Mariposa	60,000	262,000	192,000				
Mendocino				250,000			
Merced		250,000					
Modoc	93,000	40,000	96,000				
Mono	50,000						
Monterey	315,000	180,000					
Napa	52,000	636,000		40,000			
Nevada	297,000	150,000	223,000				
Placer	107,000	54 000	161,000				
Plumas	64,000	65,000	42,000				
San Diego				201,219			
San Francisco*							
San Luis Obispo	40,000						
San Mateo	54,000		24,000				
Santa Barbara	16,000	24,000	8,000				
Santa Cruz	20,000		35,000				
Shasta	194,000	85,000	136,000				
Sierra			52,000				
Siskiyou	412,000	680,000	348,000		11,248,000	20,000	130,000
Sonoma	12,500	100,000		750,000			
Tehama	178,000	5,000	42,000	4,000			
Trinity	92,000		41,000			8000	
Tulare		8,000	45,000	20,000			
Tuolumne	254,000	128,000	235,000	200,000			
Yolo				32,000			
Totals	3,512,500	4,079,000	2,750,500	1,898,219	11,248,000	28,000	130,000

*Adult mackinaw, 130

FALL CREEK HATCHERY

County	Rainbow	Salmon
Siskiyou	332,000	3,765,000

MOUNT WHITNEY HATCHERY

County	Rainbow	Loch Leven	Steelhead	Eastern brook	Black spotted	Golden
Inyo	511,000	220,000	138,000	183,000	90,000	262,000
Kern		60,000				
Los Angeles	240,000		150,000			
Mono	251,000		280,000	133,000	210,000	158,000
Orange	5,000		5,000			
Riverside	125,000		85,000	10,000		
San Bernardino	45,000	5,000	15,000	10,000		
San Diego	55,000	10,000	160,000			
Santa Barbara		12,000				
Tulare	175,000	10,000	145,000	60,000		
Ventura	80,000	20,000	155,000			
Totals	1,487,000	337,000	1,133,000	396,000	300,000	420,000

FERN CREEK HATCHERY

County	Black spotted
Mono	500,000

FORT SEWARD HATCHERY

County	Rainbow	Steelhead	Black spotted	Salmon
Humboldt	576 510	800,610	99,330	1,898,590
Mendocino	90,000	65,000		
Totals	666,510	865,610	99,330	1,898,590

UKIAH HATCHERY

County	Steelhead
Lake	120,000
Mendocino	480,000
Sonoma	150,000
Total	750,000

TAHOE HATCHERY

County	Rainbow	Black spotted	Large lake	Cut-throat
El Dorado		50,000		
Placer	110,000	700,000	825,000	90,000
Totals	110,000	750,000	825,000	90,000

TALLAC HATCHERY

County	Large lake	Black spotted
Alpine		100,000
El Dorado	410,000	200,000
Totals	410,000	300,000

CLEAR CREEK HATCHERY

County	Rainbow
Lassen	25,000
Plumas	25,000
Total	50,000

DOMINGO SPRINGS

County	Rainbow
Lassen	228,000
Plumas	385,385
Shasta	42,000
Total	655,385

BEAR LAKE HATCHERY

County	Rainbow
San Bernardino	1,375,000

NORTH CREEK HATCHERY

County	Rainbow
San Bernardino	600,000

BROOKDALE HATCHERY

County	Steelhead
San Mateo	40,000
Santa Clara	165,000
Santa Cruz	477,000
Total	682,000

FEATHER RIVER HATCHERY

County	Rainbow	Loch Leven	Eastern brook	Black spotted
Butte	40,000		20,000	
Plumas	220,000	107,000	87,500	72,400
Sierra	340,000	75,000	161,000	40,000
Totals	600,000	182,000	268,500	112,400

WAWONA HATCHERY

County	Rainbow	Steelhead
Mariposa	244,100	96,200

KAWEAH HATCHERY

County	Rainbow	Steelhead
Tulare	268,000	65,000

TRANSPLANTATION

County	Catfish	Sunfish	Crappie
Calaveras	300	300	
Lake	4,000		
Riverside		3,000	300
San Bernardino		384	100
San Diego			147
Tuolumne		450	125
Totals	4,300	4,134	672

DEER KILL BY COUNTIES, SEASON 1927

County	Number of points on each side								
	2	3	4	5	6	7	8	9	Total
Alameda	171	42	7						220
Alpine	14	21	27	2	3				67
Amador	19	18	17	4	1				59
Butte	74	68	69	13	3	1			228
Calaveras	50	47	42	5	2	3			149
Colusa	161	76	25	1					263
Contra Costa	4	1							5
Del Norte	16	12	10	4					42
El Dorado	183	173	138	32	7	1		1	535
Fresno	215	170	159	33	12	2		1	592
Glenn	284	242	88	6	3				623
Humboldt	389	258	155	15	3	1			821
Imperial	1								1
Inyo	74	48	35	11	3	1		1	173
Kern	83	72	52	8	3				218
Kings		3							3
Lake	599	229	65	6	1	1			901
Lassen	20	86	129	37	14	3	4	3	296
Los Angeles	279	92	45	8	1				425
Madera	96	77	64	14	6	1	2		260
Marin	297	58	10	2					367
Mariposa	32	31	24	4	2	1	1		95
Mendocino	853	426	180	11	5				1,475
Merced	41	21	4	1					67
Modoc		138	262	69	24	10	3	4	510
Mono	14	7	10	5					36
Monterey	541	161	41	11	1	2			757
Napa	242	155	41	3	1				442
Nevada	38	48	36	3					125
Orange	24	17	12	2	1				56
Placer	121	105	95	14	4	2			341
Plumas	177	169	167	25	8	2	3		551
Riverside	170	82	51	19	1				323
Sacramento									
San Benito	150	54	10	2	1				217
San Bernardino	32	21	14	6	1				74
San Diego	95	38	33	3					169
San Francisco									
San Joaquin	13	7	1						21
San Luis Obispo	251	103	29	8	2			1	394
San Mateo	61	13	3						77
Santa Barbara	424	154	74	16	1				669
Santa Clara	243	119	31	4					397
Santa Cruz	69	6	3						78
Shasta	171	240	164	25	4	1	4	3	612
Sierra	27	27	44	2	1				101
Siskiyou	424	491	578	120	28	10	4	10	1,665
Solano	22	16	7						45
Sonoma	519	188	37	7					751
Stanislaus	53	26	8	3		1			91
Sutter			1						1
Tehama	286	288	192	29	2	2			799
Trinity	299	339	238	35	4	4	2		921
Tulare	341	200	177	24	1		1		744
Tuolumne	64	72	52	20	1	3		1	213
Ventura	164	74	27	7	2				274
Yolo	55	36	18	3					115
Yuba	24	19	6	4					53
Totals	9,069	5,687	3,807	686	157	52	24	25	19,507

STATEMENT OF MOUNTAIN LION BOUNTIES PAID BY DIVISION OF FISH AND GAME

County	1907–1925	1926	1927	Total
Alameda	2			2
Alpine	3			3
Amador	12	1	1	14
Butte	35	1	1	37
Calaveras	20	2	4	26
Colusa	25	5	2	32
Contra Costa				
Del Norte	121	4	9	134
El Dorado	85	13	17	115
Fresno	48	4	12	64
Glenn	65	2	1	68
Humboldt	647	13	15	675
Imperial	2			2
Inyo	16			16
Kern	228	20	14	262
Kings	1			1
Lake	198	22	9	229
Lassen	9			9
Los Angeles	83	3	3	89
Madera	45	1	1	47
Marin				
Mariposa	99	13	3	115
Mendocino	323	20	14	357
Merced	4			4
Modoc	5			5
Mono	14	1		15
Monterey	210	26	23	259
Napa	3			3
Nevada	8			8
Orange	9			9
Placer	64	6	3	73
Plumas	10			10
Riverside	50	3		53
Sacramento	1			1
San Benito	45	3	1	49
San Bernardino	52	5	5	62
San Diego	58	3	10	71
San Francisco				
San Joaquin	2			2
San Luis Obispo	133	5	8	146
San Mateo	1			1
Santa Barbara	174	11	14	199
Santa Clara	44	3		47
Santa Cruz	4			4
Shasta	363	11	13	387
Sierra	6			6
Siskiyou	280	3	16	299
Solano				
Sonoma	25		1	26
Stanislaus	13			13
Sutter	2			2
Tehama	228	5	6	239
Trinity	355	11	4	370
Tulare	226	4	12	242
Tuolumne	123	11	2	136
Ventura	91	14	17	122
Yolo				
Yuba	10			10
Totals	4,680	249	241	5,170

SUMMARY, FUR-BEARING MAMMALS

Species	Estimated number		Average price		Estimated value	
	1926–27	1927–28	1926–27	1927–28	1926–27	1927–28
Skunk	39,074	56,438	$1.203	$1.564	$47,006.02	$88,269 03
Muskrat	13,261	24,736	.818	.709	10,847 50	17,537 82
Raccoon	15,527	19,182	5.639	5.474	87,556 75	105,002 27
Gray Fox	8,498	14,242	2.132	2.504	18,117 74	35,661 97
Coyote	9,631	13,941	5.070	6.452	48,829 17	83,947 33
Wild Cat	7,015	12,250	2.242	2.829	15,727 63	34,655 25
Civet Cat	4,839	9,425	.656	.636	3,174 38	5,994 30
Mink	4,867	5,854	7.057	7.782	34,346 42	45,555 83
Ringtailed Cat	3,477	4,368	2.633	3.281	9,154 94	14,331 41
Opossum	1,064	2,208	.800	.786	851 20	1,735 49
Badger	742	1,216	1.709	2.143	1,268 08	2,605 89
Kit Fox	2,145	844	2.166	2.366	4,646 07	1,996 90
Beaver	692	700	12.905	14.097	9,530 26	9,867 90
Weasel	347	661	.765	.918	265 46	606 80
Marten	479	495	10.485	15.302	5,022 32	7,574 49
Bear	291	239	8.490	6.935	2,470 59	1,657 47
River Otter	158	163	14.456	17.742	2,284 05	2,891 95
Red Fox	23	123	21.500	6.489	494 50	798 15
Mountain Lion	68	88	19.654	12.853	1,336 47	1,131 06
Fisher	32	29	42.357	39.281	1,355 42	1,139 15
Totals	112,230	167,202			$304,284 97	$168,960 46

The above is based on reports furnished by licensed trappers, and is an estimate of the total catch made by licensed commercial trappers. No attempt has been made to include an estimate of the animals trapped by minors under the age of 18 years, or those taken for private use, or those killed in predatory animal control campaigns.

	1926–27	1927–28
Number of trapping licenses issued	3,790	5,243
Number of trappers reporting	2,619	3,402
Per cent reporting	69.1	64.9

CALIFORNIA FISHERY PRODUCTS.

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1926.

(Compiled by the Department of Commercial Fisheries, Fish and Game Commission of California.)

Canned.

Species of fish	Size of cans	Northern California district, cases	Monterey district, cases	San Pedro district, cases	San Diego district, cases	Total cases
Abalone	1-lb. tall		2,256		137	2,393
	½-lb.				1,798	1,798
Albacore	1-lb.			3,837	2,743	6,580
	½-lb.			34,443	9,196	43,639
	¼-lb.			5,380	2,616	7,996
Albacore, flake	1-lb.			10	23	33
	½-lb.			7,753		7,753
Bonito	1-lb.			758		758
	½-lb.			34,268	4,850	39,118
	¼-lb.			2,471		2,471
	¼-lb. (100 to case)			1,839		1,839
Fish cakes	1-lb.			5,733		5,733
Mackerel	1-lb.				4	4
	½-lb. oval		537		9	546
Salmon	1-lb. flat	2,509				2,509
	½-lb. flat	9,252				9,252
Sardines	1-lb. oval		1,158,133	861,088	63,410	2,082,631
	½-lb. oval		31,250		2,725	33,975
	½-lb. square		233		892	1,125
	¼-lb. square		2,867	393	15,761	19,021
	6 oz. (100 to case)			21,309	5,694	27,003
Squid	½-lb.		23,536			23,536
Tonno	4-lb.			617		617
	1-lb.			102		102
	½-lb.			10,759	3,547	14,306
	¼-lb.			19,469	30,793	50,262
	¼-lb. (100 to case)			59,742	6,524	66,266
Tuna, bluefin	1-lb.			6,444	354	6,798
	½-lb.			45,329	2,401	47,730
	¼-lb.			15,752	3	15,755
Tuna, flakes	1-lb.			1,386	2,013	3,399
	½-lb.			2,637	2,126	4,763
Tuna, striped	1-lb.			17,846	4,938	22,784
	½-lb.			150,497	69,533	220,030
	¼-lb.			20,245	10,918	31,163
	¼-lb. (100 to case)			250		250
	⅛-lb. (96 to case)			743		743
Tuna, unclassified	1-lb.			4,994	877	5,871
	½-lb.			22,271	13,575	35,846
	¼-lb.			5,539	6,614	12,153
Tuna, yellowfin	1-lb.			7,725	7,816	15,541
	½-lb.			68,567	49,722	118,289
	¼-lb.			10,759	17,759	28,518
	⅛-lb. (96 to case)			3,213		3,213
Yellowtail	1-lb.			1,510	4,478	5,988
	½-lb.			6,814	6,037	12,851
	¼-lb.			50	51	101
Totals		11,761	1,218,812	1,462,542	349,937	3,043,052

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1926.

(Compiled by the Department of Commercial Fisheries, Fish and Game Commission of California.)

Salted, Smoked and Dried—1926.

Species of fish	Size or quantity	Northern California district	Monterey district	San Pedro district	San Diego district	Total
Bloaters	Pounds	35,500				35,500
Sablefish (smoked)	Pounds	213,162				213,162
Salacchini	100-lb. boxes		86			86
	50-lb. boxes		2,419			2,419
	10-lb. boxes		55			55
Salmon (mild cured)	Tierces	1,986				1,986
(smoked)	Pounds	88,000				88,000
Sardines (soused)	8-oz. jar (24 to case)		448			448
(hard salted)	Pounds		11,705			11,705
Shad (smoked)	Pounds	5,600				5,600
Shrimps (dried)	Pounds	135,137				135,137
Squid (dried)	Pounds		302,365			302,365
Mixed fish (dried)	Pounds	120,665			372,926	493,591
(mild cured)	Pounds			8,250		8,250
(salted)	Pounds		121,293	10,000		131,293

Miscellaneous Data.

Fish flour	Tons		216			216
Fish meal	Tons	464	6,843	7,066	1,394	15,767
Fish oil	Gallons	26,221	1,392,291	651,006	54,410	2,123,928
Estimated value of pack		$590,437	$5,805,290	$7,913,420	$2,155,488	$16,464,635
Number of employees		285	2,097	2,796	1,043	6,221
Value of packing plants		$525,500	$2,650,452	$4,067,169	$1,569,114	$8,812,235
Number of plants		27	16	20	10	73

NOTE.—Sardines packed and meal produced at Pittsburg included with Monterey.

CALIFORNIA FRESH FISHERY PRODUCTS FOR YEAR 1926.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Albacore								120	118,563
Anchovies							3,400		67,519
Barracuda								20,665	27,127
Bonito								15,029	43,024
Carp		13,815		3,440	17,032	21,948	3,086		
Catfish		103,859		4,675	96,629	52,214			
Cultus Cod	30,831	20,287	398				449,116	67,257	80,765
Dolphin									
Eels							20		
Flounders	22,866	88,630	156	140		867	385,639	166,509	16
Grayfish							224,966	7,230	11,442
Greenfish									
Hake							42,498	15,837	
Halibut	232,562	22,217	669				92,490	3,926	9,554
Hardhead					43,625				
Herring	6,801		10,078			1,195	421,544		
Kingfish							41,597	48,352	47,319
Mackerel	378						899	62,232	1,057,388
Mackerel, Horse									56,517
Mullet									
Perch	31,229	405	43,910			204	55,443	8,742	4,581
Pike				86	1,140	1,764			
Pompano									81
Rock Bass									
Rockfish	82,741	18,292	74				886,798	1,007,564	1,299,954
Sablefish	30,634	1,370					88,735	12,494	2,414
Salmon	2,825,840	982,295	26,083	247,700	434,763	579,313	936,330	12,235	39,520
Sandabs		31,790					906,204	191,823	1,191
Sardines			150				7,056,615	1,500	155,160,307
Sculpin									
Sea Bass—Black									
Sea Bass—White		125	43,915			282	64,597	185,566	125,685
Sea Trout									
Shad				4,972	835	12,603	7,256		
Shad—Buck				54,277	25,991	282,436	4,818		
Shad—Roe				60,365	24,509	419,576	4,564		

Sheepshead									
Skates		1,950					156,338	43,059	50
Skipjack								41,449	2,025
Smelt	31,920	97	32,391			2,468	78,590	90,995	103,489
Sole	1,760	193,770			4,426	896	6,078,453	2,090,854	179,896
Splittail									
Striped Bass		17	1,141	69,260	139,108	435,070	106,135		70
Stingaree									
Suckers		348			360	11	1,269		
Surf Fish									
Swordfish									
Tomcod							3,950	375	
Trout—Farm									
Trout—Steelhead									
Tuna									
Tuna—Bluefin									
Tuna—Yellowfin									
Turbot			1,365						
Whitebait	73,242		4,233			105	7,689		288
Whitefish									
Yellowtail									
Miscellaneous	603	19,461	28	138	152	873	11,944	8,058	30,293
Total fish	3,371,407	1,498,728	164,591	445,053	788,570	1,811,825	18,120,983	4,101,871	158,469,078
Crustaceans:									
Crabs	[1]193,080	[2]1,584	[3]15,816				[5]3,034,296	[7]47,832	[8]3,672
Eerevisse									
Shrimps			999,419			6,700	425,392		
Spiny Lobsters									
Mollusks:									2,043,023
Abalones									
Clams—Cockle		687	15,867						
Clams—Mixed	12,335	1,429	17,924						
Clams—Pismo									
Clams—Softshell		1,614	102,350			98,660	43,338		
Cuttlefish	40						8,552	4,663	49,803
Limpets									
Mussels			35			60	11,307		2,480
Oysters—Eastern			[4]25,932				[6]584,490		
Oysters—Native									
Snails									
Squid									3,127,159
Miscellaneous:									
Frogs									
Terrapins									
Turtles									
Totals	3,576,862	1,504,042	1,341,934	445,053	788,570	1,917,245	22,228,358	4,154,366	163,695,215

All amounts shown in pounds unless otherwise specified. Albacore and skipjack cleaned.

[1] 8,045 dozen. [2] 66 dozen. [3] 659 dozen. [4] 117,881 shell oysters. [5] 126,429 dozen. [6] 2,656,773 shell oysters. [7] 1,993 dozen. [8] 153 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR YEAR 1926.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican, brought into California via San Pedro	Mexican, brought into California via San Diego	Total Mexican brought into California
Albacore		1,766,033	1,966	582,643	2,469,325		60	60
Anchovies		8,197			79,116			
Barracuda	65,085	1,360,533	44,756	1,408,044	2,926,210	1,563,945	513,350	2,077,295
Bonito	15,495	2,506,388	4,790	315,242	2,899,968	139,108	39,590	178,698
Carp	4,200	8,657			72,178			
Catfish					257,377			
Cultus Cod	363	502	383		649,902			
Dolphin							3,145	3,145
Eels		155		63	238			
Flounders		2,812		54	667,689		22	22
Grayfish		42,845	12	220,228	506,723			
Greenfish								
Hake					58,335			
Halibut	228,263	468,070	43,031	154,601	1,255,383	21,511	410,826	432,337
Hardhead					43,625			
Herring	290			13,699	453,607			
Kingfish		341,981	594	4,933	484,776	20	125	145
Mackerel	16,782	1,848,476	150,817	473,126	3,610,098	1,377	11,815	13,192
Mackerel, Horse		178,243	391		235,151	4,013		4,013
Mullet		3,443	1,024	28,745	33,212		18,541	18,541
Perch	724	56,915	269	2,148	204,570	833	3,507	4,340
Pike					2,990			
Pompano		7,762		282	8,125			
Rock Bass	2,022	318,726	58,493	185,036	564,277	3,180	68,878	72,058
Rockfish	87,248	2,816,973	31,683	1,331,147	7,562,474	335	13,687	14,022
Sablefish	149	4,299	20		140,115			
Salmon					6,084,079			
Sandabs		12,699	228		1,143,935			
Sardines		113,494,174	1,238	11,027,266	286,741,250			
Sculpin	7	94,739	527	12,795	108,068			
Sea Bass—Black	2,051	23,468	6,574	87,977	120,070	8,721	249,143	257,864
Sea Bass—White	105,028	758,328	5,868	188,395	1,477,789	321,169	417,444	738,613
Sea Trout								
Shad					25,666			
Shad—Buck					367,522			
Shad—Roe					509,014			

Sheepshead	1,590	105,460	2,616	26,401	136,067		2,860	2,860
Skates		20,676	15	10,905	232,993			
Skipjack		10,065,937	718	4,150,363	14,260,492	3,545,247	3,189,083	6,734,330
Smelt	39,316	326,521	163,207	12,147	881,141	1,327	655	1,982
Sole	87,212	12,579	2,754	2,592	8,649,870			
Splittail					5,322			
Striped Bass					750,801			
Stingaree								
Suckers					1,988			
Surf Fish								
Swordfish		10,798	165	33,005	43,968		1,575	1,575
Tomcod					4,325			
Trout—Farm								
Trout—Steelhead								
Tuna		260,756			260,756	99		99
Tuna—Bluefin		6,232,762		293,771	6,526,533			
Tuna—Yellowfin		1,519,328	2,982	1,173,192	2,695,502	5,294,846	4,574,638	9,869,484
Turbot					1,365			
Whitebait					85,557			
Whitefish	4,720	286,952	289	52,375	344,336	562	23,166	23,728
Yellowtail	3,485	1,101,549	3,649	2,064,741	3,173,424	493,687	1,356,003	1,849,690
Miscellaneous	11,952	119,329	4,666	150	207,647	21,767	710	22,477
Total fish	675,982	146,187,065	533,725	23,856,066	360,024,944	11,421,747	10,898,823	22,320,570
Crustaceans:								
Crabs					[9]3,296,280			
Ecrevisse								
Shrimps					1,431,511			
Spiny Lobsters	59,589	173,484	21,143	187,982	442,198	23,357	709,668	733,025
Mollusks:								
Abalones	17,747				2,060,770			
Clams—Cockle					16,554	1,272		1,272
Clams—Mixed		150			31,838	3,514		3,514
Clams—Pismo	274,317				274,317			
Clams—Softshell					245,962			
Cuttlefish		246			63,304			
Limpets								
Mussels	657	75			14,614			
Oysters—Eastern					[10]610,422			
Oysters—Native						360		360
Snails								
Squid				8,402	3,135,561			
Miscellaneous:								
Frogs								
Terrapins								
Turtles								
Totals	1,028,292	146,361,020	554,868	24,052,450	371,648,275	11,450,250	11,608,491	23,058,741

[9] 137,245 dozen. [10] 2,774,654 shell oysters.

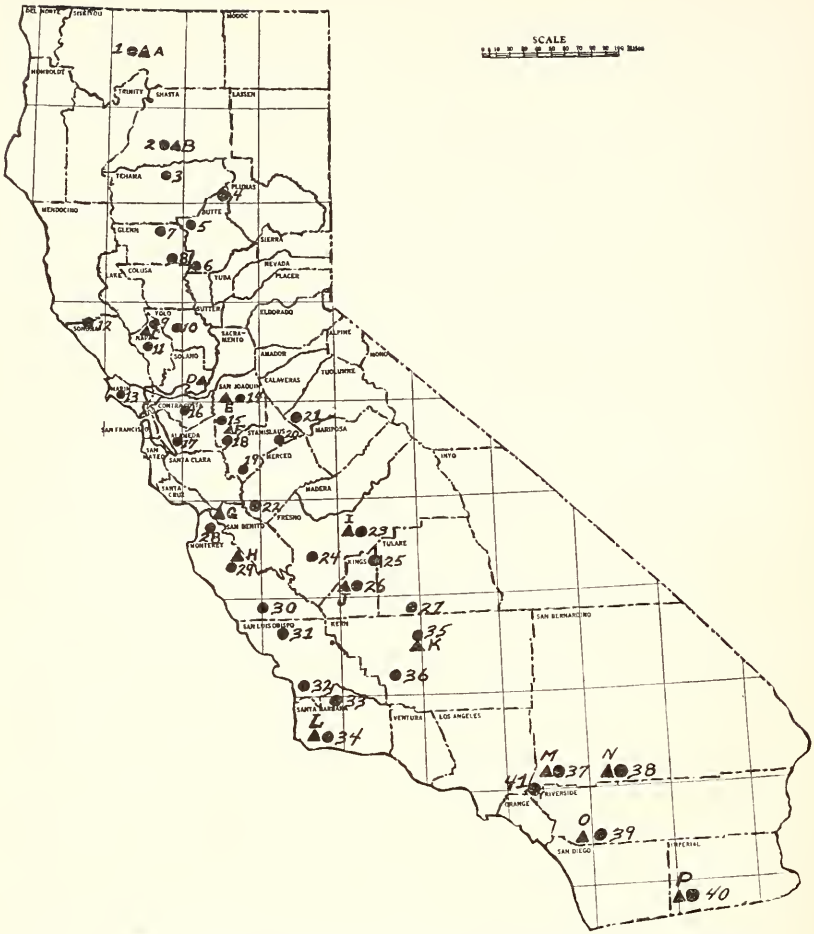


FIG. 40. Map showing pheasant plantings in California for 1926 and 1927. Map by courtesy of Rand McNally.

1926 Plantings—▲—Letters

Plant	No. of birds	Nearest Locality
A	169	Dunsmuir
B	229	Redding
C	174	Napa
D	42	Birds Ldg.
E	208	Stockton
F	278	Modesto
G	189	Salinas
H	192	Soledad
I	300	Fresno
J	175	Hanford
K	250	Bakersfield
L	252	Solvang
M	252	Chino
N	495	Colton
O	105	Temecula
P	110	El Centro

1927 Plantings—●—Numbers

Plant	No. of birds	Nearest Locality
1	126	Dunsmuir
2	462	Redding
3	100	Red Bluff
4	240	Chico
5	150	Marysville
6	150	Roseville
7	125	Orland
8	140	Willows
9	427	Napa Valley
10	240	Woodland
11	393	Birds Ldg.
12	110	Healdsburg
13	184	Point Reyes
14	126	Lodi
15	150	Crows Ldg.
16	100	Pleasanton
17	80	Centerville
18	221	Modesto
19	150	Stockton
20	72	Oakdale
21	72	Sonora

1927 Plantings—●—Numbers

Plant	No. of birds	Nearest Locality
22	150	Merced
23	557	Sanger
24	130	Coalinga
25	190	Hanford
26	140	Hanford
27	150	Tulare
28	225	Salinas
29	126	Gonzales
30	318	Soledad
31	80	Atascadero
32	120	Buellton
33	120	Santa Maria
34	80	Santa Barbara
35	150	Bakersfield
36	140	Bakersfield
37	366	Chino
38	246	Colton
39	120	Temecula
40	240	El Centro
41	240	Ontario

REPORT ON SARDINE CANNERIES, 1926–27

The first canning operations in Monterey for 1927 started in August, and all canneries except one ceased operation in March. Canning operations were started in the San Pedro district in November and continued into May. In San Diego, packing was carried on throughout the year, but on a small scale, and less than fifteen thousand cases of all size cans were packed.

The following table shows the production at Monterey and San Pedro districts. One plant was operated in northern California outside of Monterey and the output is included in the Monterey figures.

CANNERY, FISH FLOUR, MEAL AND OIL PRODUCTION

Season June 1, 1926, to May 31, 1927

District	Tons fish received	Tons fish used for canning	Tons fish used for meal and flour
Monterey	79,343	60,941	18,318
San Pedro	64,216	52,324	11,892
Totals	143,559	113,265	30,210
Deduct fish used for other purposes	3,165		
Fish used by canning plants	140,394		

District	Tons offal	Cases 1-lb. ovals packed	Cases other size cans packed	Other size cans equivalent to cases 1-lb. ovals	Cases per ton	Tons flour
Monterey	20,306	1,202,516	39,134	21,673	16.1	184
San Pedro	17,441	986,858	52,561	63,264	16.3	
Totals	37,747	2,189,374	91,695	84,937		
Add other sizes		84,937				
Equal to cases 1-lb. ovals		2,274,311				

District	Meal, tons	Ratio per ton, meal	Oil, gallons	Gallons oil per ton of offal and fish	Tons fish used for other purposes
Monterey	6,675	5.6	1,562,351	10.4	3,165
San Pedro	5,962	4.9	682,796	23.3	
Totals	12,637		2,245,147		3,165

TABLE OF CASE PRODUCTION, RATIO OF MEAL AND OIL PRODUCTION

Name of plant	Location	Kind of plant	Number of cases 1-lb. oval cans per ton	Ratio per ton of meal	Gallons of oil per ton of offal and fish
Bayside Fish Flour Company	Monterey	Fish flour		6.4	44.8
F. E. Booth Company	Monterey[1]	Cannery	16.9	5.3	42.4
California Packing Corporation	Monterey	Cannery	15.8	5	43.6
Carmel Canning Company	Monterey	Cannery	16.9	5.9	40.5
E. B. Gross Canning Company	Monterey	Cannery	15.1	5	43.6
K. Hovden Company	Monterey	Cannery	16.8	6.2	47
Monterey Canning Company	Monterey	Cannery	14.7	6.4	29.2
San Carlos Canning Company	Monterey	Cannery	15	4.8	40.7
San Xavier Packing Company	Monterey	Cannery	15.3	6	35
Sea Pride Canning Company	Monterey	Cannery	15	6.4	30
Coast Fishing Company	Wilmington	Cannery	17.2	4.7	18.1
Franco-Italian Packing Company	East San Pedro	Cannery	14.1	5.5	30.4
French Sardine Company	East San Pedro	Cannery	18.1	5	24
General Fisheries	San Pedro	Cannery	6.4	4.8	33.3
Italian Food Products Company	Long Beach	Cannery	16.3	7.8	23.5
Los Angeles Sea Food Company	East San Pedro	Cannery	14.3	4.8	23.4
Kittle-Joerissen Canning Company	East San Pedro	Cannery	16.4	4.2	17
Southern California Fish Corporation	East San Pedro	Cannery	17.5	4.7	20.6
Seacoast Packing Company	East San Pedro	Cannery	17.3	5.5	16.5
Stafford Packing Company	Wilmington	Cannery	13.8	3.7	28.7
Toyo Fisheries	Wilmington	Cannery	16.6	4.7	19
Van Camp Sea Food Corporation	East San Pedro	Cannery	16.4	5	25.5

[1] Includes operation of Pittsburg plant.

The percentages shown for various plants are based on sworn reports furnished by each plant, and same method used for all plants to arrive at above ratios.

The following table shows case pack, meal and oil production for calendar years 1916 to 1926.

1-Lb. Ovals

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	97,100	2,512	7,133	106,745
1917	331,065	43,221	34,380	408,666
1918	593,315	136,632	17,790	747,737
1919	798,566	113,909	33,594	946,069
1920	687,777	213,714	50,302	951,793
1921	287,954	77,048	1,189	366,191
1922	353,188	340,860	3,595	697,643
1923	580,464	488,885	19,215	1,088,564
1924	631,286	693,133	12,135	1,336,554
1925	737,743	920,191	29,846	1,687,780
1926	1,158,133	861,088	63,410	2,082,631

Fish Meal, Tons

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	249	261	25	535
1917	875	2,606		3,481
1918	2,874	4,737	1,123	8,734
1919	3,812	5,667	1,674	11,153
1920	3,969	3,328	1,559	8,856
1921	2,115	3,566	636	6,317
1922	2,695	5,373	959	9,027
1923	3,806	4,216	1,216	9,238
1924	6,601	7,726	1,001	15,328
1925	7,105	13,023	2,808	22,936
1926	7,307	7,066	1,394	15,767

Includes all meal produced.

Fish Oil, Gallons

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	25,563		500	26,063
1917	92,393	83,900		176,293
1918	261,466	67,858	17,400	346,724
1919	341,173	146,298	26,791	514,262
1920	419,474	152,937	39,174	611,585
1921	226,826	93,305	16,607	336,738
1922	295,858	244,310	6,882	547,050
1923	576,553	346,883	28,452	951,888
1924	1,240,296	1,059,001	51,425	2,350,722
1925	1,246,561	1,715,633	187,847	3,150,041
1926	1,418,512	651,006	54,410	2,123,928

Includes all fish oil produced.

For quick reference and comparison of activities in the manterey and San Pedro districts, a chart is given below showing receipts of sardines, number of cases packed on basis of 1-lb. oval cans, number of tons of meal and gallons of oil produced.

CALIFORNIA FISHERY PRODUCTS

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1927

(Compiled by the Division of Fish and Game, Department of Commercial Fisheries.)

Canned

Species of fish	Size of cans	Northern California district, cases	Monterey district, cases	San Pedro district, cases	San Diego district, cases	Total cases
Abalone	1-lb. tall		1,656			1,656
	½-lb.				331	331
Albacore	1-lb.			6,999	1,173	8,172
	½-lb.			93,730	17,894	111,624
	¼-lb.			2,439	1,414	3,853
	¼-lb. (96 to case)			2,430		2,430
Albacore, flakes	1-lb.			185		185
	½-lb.				435	435
Bonita	1-lb.			1,265	176	1,441
	½-lb.			14,820	3,629	18,449
	¼-lb.			1,706	639	2,345
	¼-lb. (100 to case)			42		42
Fish cakes	1-lb.			14,539		14,539
	½-lb.			6,000		6,000
Mackerel	1-lb.			10,725		10,725
	½-lb.				236	236
Salmon	1-lb. tall	11				11
	1-lb. flat	717				717
	½-lb. flat	7,707				7,707
Sardines	10-lb. round		541			541
	1-lb. oval		1,341,872	1,046,453	14,947	2,403,272
	½-lb. oval		36,363		1,001	37,364
	½-lb. square		237		4,865	5,102
	¼-lb. square		285		37,839	38,124
	6-oz. tall (100 to case)		17,808	119,815	3,386	141,009
Shad	1-lb. tall	6,485				6,485
Shad roe	½-lb. oval	2,207				2,207
Tonno	4-lb. (12 to case)			732		732
	1-lb.			13,903		13,903
	½-lb.			83,330	2,120	85,450
	¼-lb.			15,531	7,102	22,633
	¼-lb. (100 to case)			83,779	999	84,778
Tuna, bluefin	1-lb.			2,667	1,784	4,451
	½-lb.			23,898	6,136	30,034
	¼-lb.			6,799	1,725	8,524
	¼-lb. (100 to case)			217		217
	⅛-lb. (96 to case)			6,782		6,782
Tuna, flakes	4-lb. (12 to case)			124		124
	1-lb.			1,902		1,902
	½-lb.			5,605		5,605
Tuna, striped	1-lb.			16,084	18,692	34,776
	½-lb.			118,455	174,510	292,965
	¼-lb.			19,935	30,849	50,784
	¼-lb. (100 to case)			1,227	2,369	3,596
	⅛-lb (96 to case)			54		54
Tuna, unclassified	1-lb.			2,042		2,042
	½-lb.			16,458		16,458
	¼-lb.			1,163		1,163
Tuna, yellowfin	4-lb.			410		410
	1-lb.			18,209	25,663	43,872
	½-lb.			133,971	146,578	280,549
	¼-lb.			11,017	28,394	39,411
	¼-lb. (100 to case)			1,001		1,001
	⅛-lb. (96 to case)			1,152		1,152
Yellowtail	1-lb.			3,796	2,847	6,643
	½-lb.			5,001	10,769	15,770
	¼-lb.			30	2,087	2,117
Totals		17,127	1,398,762	1,916,422	550,589	3,882,900

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1927

(Compiled by the Division of Fish and Game, Department of Commercial Fisheries.)

Salted, Smoked and Dried—1927

Species of fish	Size or quantity	Northern California district	Monterey district	San Pedro district	San Diego district	Total
Anchovies (salted)	Pounds		42,100			42,100
Bismarck herrings	10-lb. pails	472				472
Mixed fish (salted)	Pounds				219,574	219,574
Mixed fish (dried)	Pounds	124,680				124,680
Mackerel (salted)	Pounds		12,000			12,000
Rollmops	10-lb. pails	401				401
Sablefish (smoked)	Pounds	78,483				78,483
Salacchini	50-lb. boxes		150			150
Salacchini	100-lb. boxes		225			225
Salmon (mild cured)	Tierces	2,020	32			2,052
Salmon (smoked)	Pounds	66,805				66,805
Sardines (salted)	Pounds		110,770			110,770
Sardines (soused)	8-oz. jars (24 to case)		70			70
Shad (mild cured)	Tierces	811				811
Shad (smoked)	Pounds	3,640				3,640
Shrimps (dried)	Pounds	80,446				80,446
Squid (dried)	Pounds		1,200,000			1,200,000
Miscellaneous Data						
Fish flour	Tons		263			263
Fish meal	Tons	480	8,867	9,746	2,018	21,111
Fish oil	Gallons	17,283	1,742,197	763,905	95,105	2,618,490
Estimated value of pack		$821,681	$6,631,610	$11,301,397	$4,593,828	$23,348,516
Number of employees		707	1,880	2,673	1,201	6,461
Value of packing plants		$1,038,200	$2,155,000	$4,576,183	$837,000	$8,606,383
Number of plants		36	14	17	8	75

NOTE.—Sardines packed and fish meal and oil produced at Pittsburg included with Monterey.

CALIFORNIA FRESH FISHERY PRODUCTS FOR YEAR 1927

Compiled by Division of Fish and Game, Department of Commercial Fisheries

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Albacore									1,051
Anchovies							278,125	661	55,939
Barracuda								9	2,635
Bonito								1,731	1,946
Carp		2,896		4,324	29,887	20,829	2,477		
Catfish		79,152		17,044	170,504	104,603			
Cultus Cod	21,390	43,061					329,356	37,230	122,747
Eels							5		
Flounders	21,755	53,860	3		206	3,688	422,590	83,257	1,546
Grayfish						102	187,342	6,625	3,775
Hake							75,951	8,602	
Halibut	509,110	48,030	44				12,753	2,484	8,093
Hardhead					32,898				
Herring	50,294		252,860			1,100	844,600	1,580	1,400
Kingfish							47,521	52,927	80,694
Mackerel							138	2,054	1,038,191
Mackerel, Horse									56,088
Mullet									
Perch	43,065		48,162			1,230	47,330	13,286	26,895
Pike				362	2,823	4,680			
Pompano								101	76
Rock Bass									
Rockfish	87,309	37,037	162				901,649	561,506	1,236,792
Sablefish	376,463	16,211					403,797	190,080	3,809
Salmon	1,856,451	1,528,898		211,999	328,317	380,470	1,488,746	216,185	500,842
Sandabs		21,098					728,265	107,960	3,539
Sardines	168		70				18,741,742	36,665	173,919,922
Sculpin								575	177
Sea Bass—Black								100	
Sea Bass—White			15,552				8,404	39,148	8,363
Shad				535	1,603	12,666	121,778		
Shad—Buck				324,562	122,198	1,539,535			
Shad—Roe				363,176	128,328	1,489,042			
Sheepshead									
Skates		390					221,928	14,645	6,407
Skipjack								1,051	

Smelt	35,205	100	29,833			2,695	91,102	106,733	73,031
Sole	4,138	200,861				197	8,987,483	752,809	117,502
Splittail					9,112	1,489			
Striped Bass			2,774	64,974	180,291	366,749	32,806		
Suckers					1,004	16			
Swordfish									
Tomcod							690		
Tuna—Bluefin									
Tuna—Yellowfin									
Turbot			3,875				75		
Whitebait	101,272		5			15	30,955	968	934
Whitefish									
Yellowtail									
Miscellaneous	1,925			165	460	477	24,559	9,853	7,336
Total fish	3,108,545	2,031,594	353,340	987,141	1,007,631	3,929,583	34,032,167	2,248,825	177,279,730
Crustaceans:									
Crabs	[1]161,520	[2]192	[3]2,112				[6]2,537,208	[7]257,736	[8]1,584
Shrimps			1,181,874				515,491		
Spiny Lobsters									
Mollusks:									
Abalones	86,000								2,712,445
Clams—Cockle	627	673	4,614						
Clams—Mixed	10,883	462	47,347						
Clams—Pismo									
Clams—Softshell			72,117			44,380	34,886		
Cuttlefish		519					3,389	1,051	31,383
Mussels							4,190	175	25,155
Oysters—Eastern			[4]65,850				[5]489,071		
Squid								260,301	5,725,181
Totals	3,367,575	2,033,440	1,727,254	987,141	1,007,631	3,973,963	37,616,402	2,768,088	185,775,478

All amounts shown in pounds unless otherwise specified. Albacore and skipjack cleaned.
[1] 6,730 dozen. [2] 8 dozen. [3] 88 dozen. [4] 299,323 shell oysters. [5] 105,717 dozen. [6] 2,223,050 shell oysters. [7] 10,739 dozen. [8] 66 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR YEAR 1927

Compiled by Division of Fish and Game, Department of Commercial Fisheries

Species of fish	San Luis Obispo Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into California via San Pedro	Fish from south of the International Boundary brought into California via San Diego	Total fish from south of the International Boundary brought into California
Albacore		3,695,515	24,365	734,441	4,455,372	23,073	100,922	123,995
Anchovies		32,126		1,350	368,201			
Barracuda	18,456	3,390,404	109,623	834,456	4,355,583	1,569,186	274,970	1,844,156
Bonito	769	725,742	4,212	386,025	1,120,425	561,238	35,294	596,532
Carp		2,601			63,014			
Catfish					371,303			
Cultus Cod	462	832			555,078			
Eels					5			
Flounders		2,239	95		589,239			
Grayfish		90,872		36,187	324,903			
Hake					84,553			
Halibut	262,418	455,112	26,986	62,148	1,387,178	1,469	483,573	485,042
Hardhead					32,898			
Herring	542			15,945	1,168,321			
Kingfish		342,320	584	5,221	529,267			
Mackerel	11,613	2,928,697	191,152	557,058	4,728,903	308	11,428	11,736
Mackerel, Horse		406,451			462,539	4,837		4,837
Mullet		5,905	510	7,171	13,586	9,074	17,316	26,390
Perch	1,337	71,185	846	1,793	255,129	6,989	775	7,764
Pike					7,865			
Pompano		3,758		790	4,725	33,247	17,155	50,402
Rock Bass	6,270	242,547	87,612	149,353	485,782	4,672	35,386	40,058
Rockfish	121,622	2,172,858	101,237	1,149,151	6,369,323	1,059	6,797	7,856
Sablefish	130	1,864			992,354			
Salmon	21				6,511,929			
Sandabs		13,798	133		874,793			
Sardines	879	143,547,031	1,015	6,027,797	342,275,289			
Sculpin	59	74,387	958	38,053	114,209			
Sea Bass—Black	3,978	25,142	35,941	117,565	182,726	14,445	270,424	284,869
Sea Bass—White	48,931	498,202	13,387	174,572	806,559	847,102	619,746	1,466,848
Shad					136,582			
Shad—Buck					1,986,295			
Shad—Roe					1,980,546			
Sheepshead	716	111,194	843	46,034	158,787		610	610
Skates		19,366	4		262,740			
Skipjack		4,789,480	2,109	1,011,009	5,803,649	13,321,014	14,682,348	28,003,362

Smelt	56,685	438,114	109,751	22,352	965,601		320	320
Sole	207,056	22,901	1,562	3,759	10,293,268		22	22
Splittail					10,601			
Striped Bass					647,594			
Suckers					1,020			
Swordfish		10,206		120,082	130,288			
Tomcod					690			
Tuna—Bluefin		4,361,453	782	536,151	4,898,386		79	79
Tuna—Yellowfin		549,819	180	45,248	595,247	12,783,271	12,555,448	25,338,719
Turbot					3,950			
Whitebait					134,149			
Whitefish	88	202,289	21	85,196	287,594	9,878	15,630	25,508
Yellowtail	39	402,424	1,333	1,031,660	1,435,456	1,239,508	1,549,889	2,789,397
Miscellaneous	10,115	114,106	2,591		171,587	16,343	19,223	35,566
Total fish	752,186	169,750,940	717,832	13,200,567	409,400,081	30,446,713	30,697,355	61,144,068
Crustaceans:								
Crabs					[9]2,960,352			
Shrimps					1,697,365			
Spiny Lobsters	103,943	215,808	26,670	161,702	508,123		982,835	982,835
Mollusks·								
Abalones	18,085				2,816,530			
Clams—Cockle					5,914			
Clams—Mixed		384			59,076	5,587		5,587
Clams—Pismo	133,000				133,000			
Clams—Softshell					151,383			
Cuttlefish	157	176	18		36,693			
Mussels	111				29,631			
Oysters—Eastern					[10]554,921			
Squid		28,329		302	6,014,113			
Totals	1,007,482	169,995,637	744,520	13,362,571	424,367,182	30,452,300	31,680,190	62,132,490

[9] 123,346 dozen. [10] 2,522,373 shell oysters.

REPORT OF SARDINE CANNERIES, SEASON 1927-1928

Canning operations started in Monterey in June, 1927, and closed in March, 1928. In the San Pedro district, a few fish were received in June, September and October, and heavy deliveries of fish were received from November to March, inclusive, with a few receipts in April and May by some of the canneries. San Diego packers received oval size fish during January, February and March and small deliveries of quarter oil size fish were received throughout the year with the exception of July, August and December.

The following table shows the production in Monterey, San Pedro and San Diego districts. One plant operated in northern California and the output from this plant is included in the Monterey report.

CANNERY, FISH FLOUR, MEAL AND OIL PRODUCTION

Season June 1, 1927, to May 31, 1928

District	Tons fish received	Tons fish used for canning	Tons fish used for meal and flour	Tons Offal
Monterey	109,744	76,322	33,202	25,437
San Pedro	67,459	51,061	16,398	17,021
San Diego	3,973	3,510	463	1,171
Totals	181,176	130,893	50,063	43,629
Deduct fish used for other purposes	6,962			
Fish used by canning plants	174,214			

District	Cases 1-lb. ovals packed	Cases other size cans packed	Other size cans equivalent to cases 1-lb. ovals	Cases per ton	Tons flour
Monterey	1,474,162	68,111	54,985	14.8	382
San Pedro	878,175	145,143	145,143	15.2	----------
San Diego	39,380	45,178	31,995	17.7	----------
Totals	2,391,717	258,432	232,123	----------	382

District	Meal Tons	Ratio per ton of meal	Oil, Gallons	Gallons oil per ton of fish and offal	Tons o fish used for other purposes
Monterey	10,538	5.5	1,859,982	31.8	[1]6,736
San Pedro	7,128	4.0	711,579	21.0	[2]226
San Diego	184	4.7	10,253	11.8	----------
Totals	17,850	----------	2,581,814	----------	6,962

[1] 6,448 tons used for manufacturing fish flour; 288 tons used for salting purposes.
[2] 226 tons used for manufacturing edible oil.

PLANTS OPERATED, SEASON 1927-1928

F. E. Booth Company	Pittsburg
Bayside Fish Flour Company	Monterey
F. E. Booth Company	Monterey
California Packing Corporation	Monterey
Carmel Canning Company	Monterey
E. B. Gross Canning Company	Monterey
K. Hovden Company	Monterey
Monterey Canning Company	Monterey
San Carlos Canning Company	Monterey
San Xavier Fish Packing Company	Monterey
Sea Pride Canning Company	Monterey
California Packing Corporation	Terminal Island
Coast Fishing Company	Wilmington
Franco-Italian Packing Company	Terminal Island
French Sardine Company, Inc.	Terminal Island
General Fisheries Corporation	San Pedro
Globe Grain and Milling Company	Ostend
Italian Food Products Company, Inc.	Long Beach
Kittle-Joerrisen Canning Company, Inc.	Terminal Island
Los Angeles Sea Food Company, Inc.	Terminal Island
Sea Coast Packing Corporation*	Terminal Island
Southern California Fish Corporation	Terminal Island
Stafford Packing Company	Wilmington
Toyo Fisheries Company, Inc.	Wilmington
Van Camp Sea Food Company, Inc.	Terminal Island
California Packing Corporation	San Diego
K. Hovden Company	Point Loma
San Diego Packing Company	Point Loma
Westgate Sea Products Company	San Diego

* Sold to California Packing Corporation, January 26, 1928.

The following table shows case pack, meal and oil production for calendar years 1916 to 1927.

1-Lb. Ovals, Cases

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	97,100	2,512	7,133	106,745
1917	331,065	43,221	34,380	408,666
1918	593,315	136,632	17,790	747,737
1919	798,566	113,909	33,594	946,069
1920	687,777	213,714	50,302	951,793
1921	287,954	77,048	1,189	366,191
1922	353,188	340,860	3,595	697,643
1923	580,464	488,885	19,215	1,088,564
1924	631,286	693,133	12,135	1,336,554
1925	737,743	920,191	29,846	1,687,780
1926	1,158,133	861,088	63,410	2,082,631
1927	1,341,872	1,046,453	14,947	2,403,272

Fish Meal, Tons

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	249	261	25	535
1917	875	2,606	----------	3,481
1918	2,874	4,737	1,123	8,734
1919	3,812	5,667	1,674	11,153
1920	3,969	3,328	1,559	8,856
1921	2,115	3,566	636	6,317
1922	2,695	5,373	959	9,027
1923	3,806	4,216	1,216	9,238
1924	6,601	7,726	1,001	15,328
1925	7,105	13,023	2,808	22,936
1926	7,807	7,066	1,394	15,767
1927	9,347	9,746	2,018	21,111

Includes all meal produced.

Fish Oil, Gallons

Year	Monterey and Northern California	San Pedro district	San Diego district	Total
1916	25,563		500	26,063
1917	92,393	83,900		176,293
1918	261,466	67,858	17,400	346,724
1919	341,173	146,298	26,791	514,262
1920	419,474	152,937	39,174	611,585
1921	226,826	93,305	16,607	336,738
1922	295,858	244,310	6,882	547,050
1923	576,553	346,883	28,452	951,888
1924	1,240,296	1,059,001	51,425	2,350,722
1925	1,246,561	1,715,633	187,847	3,150,041
1926	1,418,512	651,006	54,410	2,123,928
1927	1,759,480	763,905	95,105	2,618,490

Includes all fish oil produced.

CASE PACK, MEAL AND OIL PRODUCTION

For Sardine Packing Seasons, June 1 to May 31

1-Lb. Ovals, Cases

Season	Monterey and Northern California	San Pedro district	San Diego district	Total
1925-1926	940,906	968,495	66,074	1,975,475
1926-1927	1,202,516	986,858		2,189,374
1927-1928	1,474,162	878,175	39,380	2,391,717

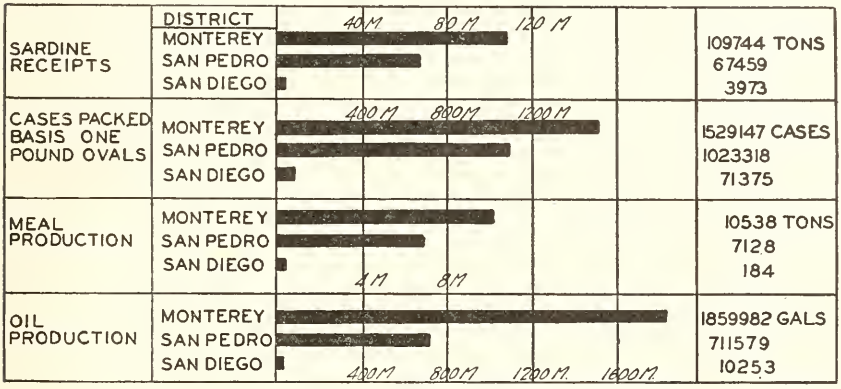
Fish Meal, Tons

Season	Monterey and Northern California	San Pedro district	San Diego district	Total
1925-1926	6,413	5,962	467	12,842
1926-1927	6,675	5,962		12,637
1927-1928	10,538	7,128	184	17,850

Fish Oil, Gallons

Season	Monterey and Northern California	San Pedro district	San Diego district	Total
1925-1926	1,113,612	658,817	43,995	1,816,424
1926-1927	1,562,351	682,796		2,245,147
1927-1928	1,859,982	711,579	10,253	2,581,814

For quick reference and comparison of activities in the Monterey and San Pedro districts, a chart is given below showing receipts of sardines, number of cases packed on basis of 1-lb. oval cans, number of tons of meal and gallons of oil produced.



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